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ABSTRACT

This document presents four background studies related to one of the major themes of the OECD Conference on Future Structures of Post-Secondary Education. The major thrust of the papers deals with structure of studies and place of research in mass higher education. Topics cover new teaching-research relationships in mass postsecondary education, the place and role of basic research in the future structures of postsecondary education, the integration of learning and research in mass higher education, and the American academic credit system. (MJM)

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CONFERENCE
ON FUTURE STRUCTURES
OF POST-SECONDARY EDUCATION

PARIS 26th-29th JUNE 1973

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STRUCTURE OF STUDIES AND PLACE OF RESEARCH IN MASS HIGHER EDUCATION

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT PARIS 1974

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FOREWORD

Policies for higher education are under active consideration in most OECD countries. A major issue in such policies in the seventies will be the setting up of structures adapted to a stage of development which has either been or is at the point of being reached in most Member countries, that of the transition to mass higher education.

To discuss a number of major issues related to policies for the future development of higher education systems, the OECD organised, in the framework of the programme of work of its Education Committee, a Conference on Future Structures of Post-Secondary Education, which took place in Paris, June 1973. High officials responsible for education policy in OECD Member countries, including a number of ministers, attended the Conference together with teachers, administrators and participants from trade union and professional organisations.

The central concern of the Conference was to examine the advent of mass higher education in its main patterns and characteristics and to identify alternative policy measures for facilitating the overall structural transformation of the system towards meeting its new objectives in the context of social and economic development.

A first volume published under the title Policies for Higher Education presents the General Report of the Conference. The present publication contains a series of four background studies relating to one of the major themes of the Conference "Structure of Studies and Place of Research in Mass Higher Education". A third volume: "Towards Mass Higher Education: Trends, Issues and Dilemmas" groups together a further series of supporting studies prepared for the Conference.

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NEW TEACHING-RESEARCH RELATIONSHIPS IN MASS POST-SECONDARY EDUCATION

by

Stuart Blume

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I

THE PROBLEM

In planning the development of post-secondary education, what should be done about research? There is no doubting the current importance of this problem or policy-makers' need for solutions, which will remain viable over a reasonable period of time. This paper does not seek to provide any such comprehensive solutions, nor could it properly so. Traditions, values and political pressures differ too substantially between one country and another for any conceivable recommendations to have universal value or applicability. Our intention is simply to point out some of the issues to which policy-makers should address themselves, and some of the partial solutions adopted in one country or another which may have a wider (if not universal) applicability.

It must be stated at once that we have opted for an educationalist's perspective, in contrast to that of the science policy-maker. We have not sought a consensus. There is no reason to suppose, and there may be reason to doubt, that the two perspectives are necessarily congruent. (1) The educationalist must be concerned above all (in the present context) with the proper place of research in the higher education system; the science policy-maker is likely to be concerned with maximizing the contribution which that system can make to the nation's objectives in research (see Table 1). In our view, science policy considerations have, in recent years, been more forcefully articulated, and have carried very much greater weight in many countries. What then, are the elements of the educationalist's response? In this paper we shall describe the impact upon the academic system of developing science policies, and outline some partial attempts at coming to terms with these effects.

1. Policy towards postgraduate education is most obviously the frequent result of unplanned compromise between educational and science-policy considerations. An earlier Secretariat report indicated the need for some forum, within each country, in which the attempt could be made to reach consensus on that particular issue. See "Postgraduate Education: Structures and Policies", OECD document, Paris, 1972.

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II

WHAT IS RESEARCH?

DEFINITION BY PRODUCT

In the measurement of research activity, the definitions given by the OECD's "Frascati Manual"(1) have acquired a widespread currency. It is therefore worthwhile taking them as a starting point for our discussions here:

> "Research and experimental development may be defined as creative work undertaken on a systematic basis to increase the stock of scientific and technical knowledge and to use this stock of knowledge to devise new applications."

Basic research is defined as follows:

> "Basic research is original investigation undertaken in order to gain new scientific knowledge and understanding. It is not primarily directed towards any specific practical aim or application."

Thus "research" is defined as a sub-category of "creative work" distinguished from other such work by its systematic basis and by the fact that it must, at least in principle, be capable of contributing to the stock of scientific knowledge. The results of basic research must be acceptable in principle as a valid extension of scientific understanding. Now, what sort of findings fulfil this criterion? On the one hand the findings must be capable of passing certain technical tests: falsifiability, replicability, and so on. On the other hand, potentially acceptable findings must pass certain "social" tests, since the systematic, developmental nature of science derives very substantially from its communal (or social) nature. (2) In other words, the research findings must be available for evaluation by the scientific community (they must be intended for publication), and they must be capable of passing the tests imposed by the community. Among these tests originality figures prominently: little value is placed upon the second solution to a problem, even if arrived at independently. (3) Secondly, as a consequence of the jealously-

1. "The Measurement of Scientific and Technical Activities: Proposed Standard Practice for Surveys of Research and Experimental Development", (OECD document, 1970, mimeo).

2. See J. Ziman, Public Knowledge, Cambridge University Press, 1968.

3. The sociologist Robert Merton has emphasized the societal importance attached to originality in research. See his "Priorities in Scientific Discovery: A Chapter in the Sociology of Science", American Sociological Review 22 (1957), pp. 635-59. The philosophers Popper and Lakatos go further, denying that anything not strictly "creative" is science at all.

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guarded professionalism of science, the work must be done by an "accredited" scientist. The scientific community will tend automatically to reject the contributions of amateurs, or of the practitioners of one discipline (unless of extreme eminence) seeking directly to contribute to another. (1) Thirdly, problems to be solved, appropriate methods of problem-solving, theories to be used in explanation: such matters are largely to be determined by the internal "paradigm" of a scientific discipline or speciality. (2) Work on a problem not regarded as important by the scientist's peer-group is unlikely to be regarded highly, however correct the solution. This is a difficulty which scientists working in new or "deviant" specialities (parapsychology would be an extreme example of such deviancy) are particularly faced with.

Thus the criterion with which we began - that the findings ought in principle to represent a possible contribution to the advancement of scientific knowledge - is in practice a very restrictive one. Because of the orthodoxy, the protectionism of the scientific community, it implies originality, but constrained by choice of an acceptable problem and methodology, and it implies a properly accredited scientist. This characterization derives from a definition of basic research in the natural sciences : in an addendum to the "Frascati Manual" Jeremy Mitchell uses only slightly modified terms for a definition of research in the social sciences and the humanities. (3) However rightly or wrongly adademic research is frequently equated with basic research.

Of course, not all research is of this kind - far from it. R and D statistics show that in money terms very much more effort is devoted to applied research (directed towards a specific practical objective). Yet, and in spite of the fact that in the USA much applied research is carried out in the universities, basic research is of particular significance in the present context. It is regarded as the principal research function of the university, and the university is regarded as the proper home for most basic research. Also it has a particularly high status in the scientific community.

The volume of basic research has increased very substantially in post-war years. We may inquire into the reasons for this. Limiting ourselves to that carried out in universities, we may say that the volume of research is the result of three resource-allocation procedures: by the individual scientist; by the academic institution; by the nation (through its government). What rational grounds for such decisions may be identified? What does each resource investor hope to obtain from his investment?

Take the individual academic first. We may say that he engages in research because in the course of his scientific training he has internalized the values of the scientific community: he has learnt to value the esteem of his disciplinary peer-group, which is offered as a reward for successful research. Many empirical studies in the sociology of science have shown how the receipt of professional esteem, or recognition, depends upon the quality and volume of a scientist's published research. (4)

1. The so-called "Velikovsky affair" is the best example of this. See A. de Grazia (ed.) The Velikovsky Affair: the War of Science and Scientism, New York University Press, 1966. More generally, see S. Barber, "Resistance by Scientists to Scientific Discovery", Science, 134, 1961, pp. 596.

2. Use of the term paradigm, the proper meaning of which is highly controversial, derives in this context from the work of Thomas Kuhn. See his The Structure of Scientific Revolutions, Chicago University Press, 1962.

3. "The Measurement of Scientific and Technical Activities: Proposed Standard Practice for Surveys of Research and Experimental Development", op.cit., Addendum.

4. See for example J.R. Cole and S. Cole, "Scientific Output and Recognition: A Study in the Operation of the Reward System in Science", American Sociological Review, 32, 1967, pp. 377-390.

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At the same time, the career of the academic scientist within the university depends very largely upon his research performance. (1) Whilst many may criticize the unsuitability of such a uni-dimensional avenue of advancement, and have stressed the need for promotion-based-on-teaching, few would doubt the validity of this analysis of the current situation.

Consider now the academic institution. Why do newly-established higher educational institutions attach such importance to obtaining provision for research? Why have so many of the better American liberal arts colleges become increasingly involved in research? There are two kinds of answers which may be given. One depends upon the widespread academic belief (or myth) that "research benefits teaching". Few academics would actively reject this view. To be sure, such empirical evidence as there is is contradictory, (2) and it may simply be that the best teachers also happen to want to do research. Nevertheless, by making the institution attractive to the research-minded, its directors may hope thereby to attract the best teachers. (Even if there were actually a null relationship between research ability and teaching ability, this might be an adequate means of attracting candidates - provided it entailed no disadvantages.) There is a second reason for the importance attached by academic institutions to research. Research has long been an important determinant of institutional status in the academic community - perhaps all the more so as research funds became more readily available.

Thus, for their various reasons, both academic scientists and academic institutions have a deep and self-interested commitment to research.

The commitment of governments to the support of research is necessarily rather different. Many reasons are put forward: some truly persuasive, others solely ex post facto rationalizations. A small measure of support is justified by a view of science as an aspect of culture - by analogy with the arts. Governments may talk of "maintaining a basic research capability", or seek international prestige from a radio telescope or a programme of fusion research. Most frequently, they are in search of some practical return - military, economic or social - on their investment. The rapid rise in basic research expenditure between 1945 and 1965 was justified in terms of the expected "pay off". It was actually a consequence of government's persuasion by the scientific community on the one hand of the inseparability of research and teaching in the university (and hence university expansion entailed research expansion), on the other, that basic research could indeed by expected to yield substantial long-term dividends. The more recent decline, paralleling a decline in the influence of scientists in government, may be attributed principally to a disenchantment with the practical benefit of science.

We have sought to characterize scientific research by its products, a notion which obviously enables us to distinguish between basic research and applied research. But one may speak more broadly of the products of basic research: for the scientist professional recognition and career advancement; for the institution status and (hopefully) good teaching; for the nation prestige, and an increasingly uncertain profit. It is research

1. See T. Caplow and R.J. McGee, The Academic Marketplace, Basic Books, New York, 1958, especially Chapter 4.

2. See for example J.R. Hayes, "Research, Teaching and Faculty Fate", Science, 172, 1971, pp. 227-230 and J. Harry and N.S. Goldner, "The Null Relationship Between Teaching and Research", Sociology of Education, 45, 1972, pp. 47-60.

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of this kind which is traditionally associated with the university. In discussing the place of research in higher education, can we be content with this characterization of research? "No" says the science policy-maker, "because you have ignored the contribution which universities can, and do, make to the nation's needs in applied research." Of course, this is true, but the criticism still depends upon an evaluation of research in terms of its product. The pedagogue may offer a rather different criticism.

DEFINITION BY PROCESS

The scientific community evaluates research in terms of the magnitude of the contribution which its findings make to the advancement of science. The quality of the research is primarily the value of its findings. The process by which the results are obtained is traditionally idealized (made to appear logical, inductive) and may often be partially concealed. Needing only to be replicable, it has little intrinsic interest for the scientific community. Yet for the educator the benefit of research may inhere particularly in the process of exploration - it matters little what results are obtained. In fact, such a view is implicit in the notion that "research benefits teaching". Adherents would never suppose that these benefits are simply long term curricular improvements in the light of new knowledge, but that they are primarily a result of the stimulating effect which doing research has upon a man's teaching. The same view - research-as-doing - underlies the use of research as a pedagogic device. We are speaking in particular here of the use of exploratory methods by the student to master material which had previously been learnt from textbooks or lectures. Such exploration - research - may be either "pure" or "applied" in product terms. Such methods can be used to extend the academic curriculum by forcing it into contact with the problems of the real world: for example, in encouraging the preclinical medical student to deal directly with patients. For such a student his contact with the patient is a kind of applied research, in which he explores the relationship between his academic knowledge and a situation which to him is both new and meaningful. Of course, to evaluate the research in terms of the pedagogic effects of doing it is not to deny that there may be valuable products. Hopefully, the student can help the patient. Students may tackle problem-situations which would not be of sufficient interest to professional scientists, and useful solutions may emerge.

Returning to research conducted by teachers, the view that the stimulus to exciting teaching may come from the process rather than the product of research has important implications for our current problem. In a number of countries a similar distinction is increasingly made between "frontier research" and what may be called "teaching-linked research" or "reflective inquiry". In their recent report to the Association of Universities and Colleges of Canada, (1) Louis-Philippe Bonneau and J. A. Corry elaborate on this distinction. "Frontier research", the direct investigation of phenomena, is largely empirical (and, they rightly point out, empirical research tends to receive particular encouragement):

1. Louis-Philippe Bonneau and J.A. Corry, Quest for the Optimum: Research Policy in the Universities of Canada, AUCC, Ottawa, 1972, especially pp. 30 et seq.

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"But whether empirical or intellectual, whether one follows his nose or is led by his mind ... it is still exploration on the frontier of knowledge, trying to gain new ground for the map of knowledge." "Reflective inquiry" on the other hand is frequently the attempt at synthesis. "We are not digging in specialized depth on the frontier: we are ... reflecting on known knowledge, including the latest reports from the frontier." It is the latter, rarely the former, which is vital for good undergraduate teaching. Yet it is the former which is of particular status today. To quote from Bonneau and Corry once more:

> "Even in the universities, research usually conjures up visions of equipment and a range of empirical experiments, observations, and surveys rather than anxieties about the adequacy of libraries. Partly for reasons of finance and prestige (and partly because the achievements of reflective inquiry are harder to assess) most universities have been induced to bias their policies on promotion and salary increases in favour of those members of the teaching staffs whose activities in frontier research win substantial grants from external agencies, and produce published papers in the learned journals."

Few can doubt that this attitude is no longer confined to the natural sciences. Robert Nisbet, in his critique of the modern American university, (1) rightly points out that it has been substantially catalyzed by the growth of the "project" system of funding research, of which we shall have more to say below.

The thesis underlying this paper may thus be roughly summarized as follows.

a) The higher education system has over responded to the professional-scientific view of science-as-product, emphasized in science policy.
b) The extent of the commitment which the education system can make to frontier research must be determined in the light of that system's principal role in education. To make decisions of that kind requires an appreciation of the pressures brought to bear on the system by the needs of scientists (for recognition) and of science.
c) Certain kinds of research do not belong in the academic system, either because they cannot, even in principle, make any contribution to its educational role (e.g. for reasons of secrecy) or because, by virtue of their sponsorship or for other reasons they stimulate active disruption of the academic community.
d) At the same time, research may make a more positive contribution to education than appears from any discussion simply of research-as-product.

1. Robert Nisbet, The Degradation of the Academic Dogma, Heinemann, London, 1971.

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III

PROJECT FUNDING AND ITS CONSEQUENCES

THE GROWTH OF PROJECT FUNDING

Academic research in European countries is characteristically financed from two governmental sources which, together, provide for most of the research effort. This dual-support system, as it works in a number of countries, has been discussed in detail in a recent OECD study. (1) We may therefore confine ourselves to a brief outline.

One channel of support is from funds typically provided by the national or regional government for the general operating of the university or directly of its component institutes (which may or may not be financed via the central university authority). The traditional view of the professor's role as necessarily including both teaching and research has meant that such funds always include an element of provision for some research (Table 2). The second channel of support is from a pool of money made available in almost all countries for the support of high quality basic research. This pool is typically administered by a semi-autonomous body which we may generically call a research council. (2) Although funds are employed in ways which invevitaly differ from one country to another the processes of utilization nevertheless have much in common. It is important to note that the two sources typically allocate funds on very different criteria. The first, using some sort of formula-basis, will take particular account of the size of the institution and the number of its students. In some countries it is the case that an institution is allowed considerable latitude in the use it makes of such funds; dividing them between its teaching, research and other functions as it sees fit. In the United Kingdom these University Grants Committee (UGC) funds may also be divided between departments as the university itself prefers. Research council funds are allocated differently, generally in response to project application by a single scientist, upon the evaluation of a committee of his peers. In general each of these committees of peers has been authorized to divide up the funds allotted to its specific discipline between applicants largely on the basis of the intrinsic scientific worth of their proposals.

The essential point we wish to make here is that in many OECD countries (and especially in the larger ones) post-war years have seen

1. The Research System, Vol. I - Germany, United Kingdom, France, OECD, Paris, 1972 ; Vol. II - Belgium, Netherlands, Sweden, Norway, Switzerland, OECD, Paris, 1973.

2. See Science Research Councils in Europe, The Working Group of the Science Research Councils, G. Friborg (ed.). Stockholm, 1972.

an increase in the extent to which academic research has been financed on this kind of "project" basis. Some illustrative figures are given in Table 3.

In order to understand these developments it is necessary on the one hand to take note of the reasons why governments chose to establish research council-type organisations, and on the other of the rationale behind their rapid budgetary growths.

Although in the United Kingdom the Department of Scientific and Industrial Research (DSIR) (which amongst other functions awarded research grants prior to the establishment of the Science Research Council in 1964) was founded in 1919, in France the "Centre national de la recherche scientifique" (CNRS) in 1939, and in Canada the National Research Council in 1917, on the whole government agencies with a principal commitment to the support of basic research are a relatively new development. Many such bodies were established shortly after the war: the German Research Council (Deutsche Forschungsgemeinschaft) (DFG) in 1949, the American National Science Foundation (NSF) in 1951, the Dutch ZWO (Netherlands Organisation for the Advancement of Pure Research) in 1950, the Norwegian Research Council (Norges Almenvitenskaplige Forskningsråd) (NAVF) in 1949, and the Swiss National Fund in 1952. (In some of the smaller countries they are of still more recent date: e.g. Denmark (1968), Finland (1961), etc.) Post-war developments of this kind were precipitated by the lesson of war. In this respect the establishment of the National Science Foundation, which derived from ideas in Bush's report to President Truman, Science, The Endless Frontier (1945), was typical. In fact political controversy delayed the establishment of the foundation till 1950 when, in an Act of the 81st Congress, it was given the following functions (inter alia):

"The Foundation is authorized and directed

1. To develop and encourage the pursuit of a national policy for the promotion of basic research and education in the sciences;
2. To initiate and support basic scientific research and programmes to strengthen scientific research potential in the mathematical, physical, medical, biological, engineering, and other sciences, by making contracts or other arrangements (including grants, loans, and other forms of assistance) to support such scientific activities and to appraise the impact of research upon industrial development and upon the general welfare."

The budget of the Foundation subsequently grew from $225,000 in 1951 to over $16 million in 1956 and to over $176 million by 1961. In 1969 the NSF provided $362 million for academic science. In Germany the budget of the DFG grew from DM. 10 million in 1950 to 25 million in 1955, to 50 million in 1960, 140 million in 1965, and 240 million in 1969.

We have already touched on some of the reasons why these basic research funding agencies were able to obtain such rapid rates of growth. Essentially it was because the scientists who argued on their behalf in policy-making circles were able to deploy what seemed powerful arguments in favour of a substantial national commitment to basic research. Technological (and economic) development were seen as dependent upon a stock of basic discoveries in need of continuous replenishment. Academic research was required in order to provide the large numbers of scientists who would be "needed" by an industrial system which was increasingly research-based. The training function of academic research cannot be ignored. Further, research was seen as an essential adjunct of high quality teaching. In Britain the Council for Scientific Policy in its first (1966) report expressed the view that:

"We are entirely at one with the (Robbins) Committee's insistence that "it is of the utmost importance that the ablest (undergraduates), who are capable of going forwards to original work, should be infected at their first entry to higher education with a sense of the potentialities of their studies (. . .) There is no border-line between teaching and research; they are complementary and overlapping activities (. . .)

"We consider that the volume of research conducted in universities should keep pace with the growth in teaching functions."

Finally the notion of "sophistication" acquired a widespread currency - the increase in costs of research per scientist after correction for inflation and salary increases - being supposed in some way to be a measure of the need for increasingly costly facilities. (It has recently become apparent that quantitative indices thus derived reflect largely the growth in the availability of money for research, rather than any intrinsic measure of the needs of science.) Arguments such as these carried great weight, and were usually employed with success by the scientific community.

There was another relevant factor of which we should take note. Beyond the activities of basic research agencies such as the NSF, many mission-orientated government agencies were increasingly convinced of the benefits to be had from contracting out substantial portions of their own research programmes to universities. The most apparent demonstration of this policy is to be found in the so-called Federal Contract Research Centres (e. g. the Radiation Laboratories at Berkeley, the Lincoln Laboratory at Massachusetts Institute of Technology) established by the American Department of Defence, the Atomic Energy Commission, the National Aeronautics and Space Administration (NASA). These were on the campuses of, and managed by universities. Many scientists held joint appointments. Of course contractual work of a smaller kind was widespread in many countries.

Later we shall suggest that many of these arguments have begun to lose their cogency. In countries in which project funding of academic research has become most widespread new reasons for the inevitable, or desirable, movement of this most advanced research out of the universities are seen to have an increasing appeal. However, at this stage we must make an important distinction between countries of that kind and others in which academic research is still very largely financed from traditional educational sources. In the Netherlands for example ZWO finances only about 10% of academic research, and in Denmark only 7% is financed by the research council. Here, rapid growth rates in research council budgets are probable, with an increase in the dependence of university research upon project funding a specific objective of policy. But the rationale is necessarily different from that given elsewhere in earlier years. The intention is less to expand the volume of academic research per se than to subject an increasing proportion of it to criteria of professional evaluation. There is a feeling that the distribution of research effort between disciplines should more accurately reflect national priorities in science, and be less a consequence simply of the relative expansion of student numbers in the various disciplines. Moreover, not everyone teaching in the university is equally competent in research: peer group evaluation (the project system) should ensure that a greater share of resources go to the more competent.

We have suggested that the essential function of the research councils is to respond to the needs of individual research scientists as expressed in project-applications, bearing in mind principally the intrinsic scientific merit of each proposal. In practice this simple characterization is applicable only in the cases of those smaller countries in which research councils dispose of relatively slender resources. With a few exceptions the research councils in the Scandinavian countries, in Switzerland, Belgium and some other smaller OECD countries prefer to react to the requirements of academic scientists. By contrast, their American, British, French and German counterparts have been continuously evolving new working methods in the attempt to promulgate more formalized policies. They have become increasingly active in determining for themselves priorities in the utilization of funds, rather than allowing priorities simply to reflect the pressure of applications.

In France the CNRS has traditionally acted on the one hand through its own laboratories and research groups (127 laboratories, 98 research groups in December 1970), on the other through contractual agreements associating specific academic research groups with itself. Senior scientists in universities and other "grands établissements" have long been able to seek support for their work in this way on a 3 or 4 year renewable basis. Such support would often include the finance of special research posts. In 1966 a new method of support, "Recherche coopérative sur programme" (RCP) was introduced. RCP's are intended to foster cooperation between research teams in one or many laboratories which may even be geographically scattered.

Each RCP is steered by a "commission permanente" composed of individuals with knowledge of the theme specific to each programme. The commission is intended to advise the director of the RCP both on scientific and administrative matters. In 1971, based largely upon the highly successful "actions concertées" of the "Délégation générale à la recherche scientifique et technique" (DGRST), the CNRS initiated a programme of "actions thématiques programmées" (ATP's). Certain areas of research will be selected by the CNRS as of special priority, and scientists will be invited to seek support from funds allocated for this purpose. This procedure is an attempt to orient academic research, at least in part, towards areas of research felt to be particularly compatible with national goals. At present about 5% of CNRS resources are devoted to the ATP programme, a figure which is not expected ever to rise beyond 10%. However the CNRS hopes that funds spent in this way will exert an influence far beyond their quantitative volume. The indication of specific areas as being of particular importance, may serve to elicit applications in the fields of declared ATPs, but outside the ATP programme. Beyond the initiation of such new mechanisms of support, there is one other important way in which the CNRS is seeking a more active role. This is in its increasing concern with regional aspects of its policy. The remarkable degree of research concentration in the Paris region (61% of researchers) is well known, and is of concern to the CNRS. Current policy is devoted on the one hand to the selective development of provincial universities which are already of high quality (e. g., Grenoble, Strasbourg, Toulouse), on the other to the development of a

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more effective research capability in certain universities in the less industrialized regions of France. (1)

In Germany, the DFG unlike the CNRS has no institutes of its own. (However, similarly autonomous research institutions are operated, often in close contact with universities, by the Max-Planck Society.) The role of the DFG is largely confined to the support of individual scientists. From its foundation this has been done principally by supporting the best of the applications made to it, on their own initiative, by individual scientists (whether from a university or some other institution). Support is generally offered for a limited and fixed period. This is what we have been referring to as the traditional function of research councils. But as early as 1952 a separate mode of finance, the "Schwerpunkt" (priority) programme was introduced, partly in the attempt to fill gaps in German science resulting from the war. Areas of research are recommended for designation as "priority areas", whether by academic scientists, officials of the DFG, representatives of public organisations concerned with applied science, etc. Representatives of the academic disciplines concerned are consulted on the value of such designation, upon the precise delineation of the area to be covered, and upon the names of scientists who may be especially competent within it. When the programme, and the list of scientists, has been approved by the various relevant committees of the research council, the scientists nominated are invited to apply for support under the specific priority programme. Whilst it is important to note that initiation of such programmes is not predominantly by the DFG itself, the priority programme is a clear step away from passive response to the requests of scientists. It is interesting to note the relative evolution of these two schemes. Expenditure on the normal or traditional programme rose from DM. 10. 6 million in 1955 to 72 million in 1965 and 98 million in 1969. Expenditure on the priority programme rose from 13. 9 million in 1955 to 51 million in 1965 and 58 million in 1969. The priority programme, which has not particularly increased its share of resources, is also largely limited to the natural and engineering sciences.

In addition to the priority programme, a scheme of special research areas (Sonderforschungsbereiche) was introduced in 1967. As early as 1960 the German Science Council (Wissenschaftsrat) had suggested that the needs of much modern research (in terms of scale of resources, need for multidisciplinary co-operation, etc.) were incompatible with university structures. Much research was seen as requiring large specialist research groups, with expertise crossing the traditional institute boundaries. The necessary scale of such activities was such that no university would be likely to allocate them to a single field, nor could they properly be duplicated from one university to another. Specific new fields of research should be concentrated in one or another university. It was also intented that the programme would on the one hand facilitate closer co-operation between scientists from universities and from other research institutes who might work together irrespective of institution; and on the other to ensure a higher degree of co-ordination of research between the research institutes of a given area, land, or throughout the whole country. Universities may suggest research fields

1. The relations between scientific and regional development policies is one of the themes discussed by the Research Commission of the 6th Plan. The Commission calls for a close and permanent relationship between the DGRST [which among other functions provides the Secretariat for the Central Advisory Committee on Research (CCRST)] and the Regional Development Agency [Délégation à l'aménagement du territoire (DATAR)].

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for inclusion in the list of special research areas. In doing so they are required to give their reasons for making this suggestion, details of the work proposed, and of the scientists and institutes who might be involved. The agreement of the Land Education Ministry must be secured, since the existence of such a programme is seen as a profound influence upon the future structure of the university. The German Research Council then evaluates the suggestion from a supra-regional point of view, focussing less on the needs of the university than on those of German science as a whole. If the detailed proposal is subsequently found scientifically satisfactory, support may then be made available by the Council. It is important to note that a programme for approval requires that the host university commit itself to increased support from its own resources (in the form of buildings, appointments) even at the expense of developments in other fields. Hitherto in selecting areas for inclusion, special attention has been given to medicine, the natural sciences, and technology: in 1970 DM. 64.5 million was spent on 77 special research areas.

In the United Kingdom the 5 Research Councils all work in slightly different ways, differing in particular in the extent to which their work is conducted in their own institutes independent of universities. However all the Councils offer research grants in response to applications from university scientists, for projects "of a special timeliness and promise". We are concerned here with the developments in policy towards university research indicating modification of the traditionally passive role.

Both the Agricultural and Medical Research Councils have long operated their own research units in association with universities. The Medical Research Council (MRC) has about 75 such units, the Agricultural Research Council (ARC) about 11. The intention in establishing such a unit is to support a problem-orientated research activity not easily accommodated within the university structure. Units are explicitly formed around a specific individual who may be a university professor or a Council employee, who is usually given the university status of Honorary Professor. The staffs of the units are employees of the Council not of the university. Such units are on "indefinite tenure", but are also subject to termination for various reasons including the retirement of the director. In fact the percentage of all research council support to research in and on the university which has been in this form has decreased substantially over the years, from about 50% in 1957 to about 25% in 1967. In 1960 the MRC introduced a new form of support, the research group, to be distinguished from the units on the basis of their intended integration into the university structure. The groups are established where it is felt that the development of a given area of bio-medical research is in the national interest and can best be achieved by the provision of a grant to a particular university, to enable that university to expand the staff and resources devoted to the line of research in question. The objective of the scheme is to ensure the institutionalization of the research on a greater scale (e.g., as a new department of the university). The university is required to regard the development of this field as a major priority in the allocation of its own resources, and to undertake to fund the group from its own resources after a period of some years.

The Science Research Council (SRC) (the largest of all) does not carry out research of its own, or operate its own units, other than the national facilities provided for the use of all university scientists. Recent years have however seen important developments in SRC's research grant policy. Specific innovations in policy must be seen against the background of the Council's "increasing concern to support work of economic and social value" and in the light of its view that "the implementation of these policies will inevitably mean that SRC will exercise more

influence over university research". Two important innovations spelt out and widely publicized in 1970 are the policies of Selectivity and Concentration. The first may be defined as follows:

> "Certain areas, within a discipline or embracing a number of disciplines, will be selected for more favourable than average support during a given period, on the basis of a review of their special potential for advancing basic science, or their economic or community value, or all three. Other important criteria will be the economy of scarce manpower and the optimum utilization of unique or expensive facilities in universities, national and international laboratories and in industry."

In the selected fields (e. g. enzyme chemistry and technology, polymer science, organo-metallic chemistry, control engineering) the intention is to facilitate the development of research groups, and scientists have been invited to apply for funds specifically allocated to each of these fields. At present about a quarter of the support given in the basic science fields and one-third of that in engineering is given to the selected fields: proportions which are not expected to rise greatly. The Concentration policy works in conjunction with the Selectivity policy: support being concentrated in selected departments as well as in selected fields. This concentration of resources is increasing. In 1971, 46% of all research grants to universities and other post-secondary institutions (over 100 institutions) went to just 7 universities: the same institutions 4 years previously had received 41% of resources. The extent of this concentration varies between disciplines, and it is important to note that whereas a few institutions have obtained a substantial share in almost all fields (e. g. Cambridge, Oxford, Imperial College, University College, Birmingham and Manchester Universities), a number of others are favoured over a more limited range (e. g., Sussex and Southampton in Chemistry, Nottingham in Mechanical Engineering, Leicester in Biological Sciences, Edinburgh in Computing and Biological Sciences). A second group of 8 universities of this kind thus share 22% of resources, leaving 32% for the remaining 90 or so universities, university colleges, polytechnics, and other institutions. Of course it must constantly be borne in mind that such apparent inequalities must reflect not only the policy of the research council but the volume and quality of applications forthcoming from the various institutions.

When we turn to the United States the situation is inevitably more complex, in part because the NSF does not occupy the pre-eminent role among federal agencies that the British research councils, CNRS or DFG enjoy. If we look at the provision of federal funds for all basic research through the 1950's and 60's, we find that whereas the NSF financed a constant fraction (about 10%) the share of funds deriving from the space agency NASA rose from 8.5% in 1956 to nearly 40% in 1966. University scientists have always had access to these funds, and the plurality of sources of support for university research has been a major source of strength for United States science. In the support of university research the contribution of the NSF has always been greater, but still relatively small. In 1969 some 16% of federal support for university research came through the NSF. Clearly one could not therefore discuss the impact of federal research funds upon American universities simply in terms of the programmes and policies of the National Science Foundation. In fact here we are concerned rather to demonstrate the erosion of traditional laissez faire policies, and to chart the simultaneous development of more interventionist policies towards government support for university research. Since among United States federal agencies the NSF was unique, by virtue of the fact that it alone had a traditional responsibility to the support of basic research for itself, it is here, if anywhere, that

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the laisser faire policy of "passive response" to the articulated wants of academic scientists may be thought to have been located. (Indeed, in 1966 a Congressional Committee complained that NSF policy had more often been directed "toward the academic interests of the researchers than towards the needs of national policy".) So for the purposes of this section there is some value in a brief consideration of changing NSF policies.

Perhaps the principal deviation from the traditional policy towards university research had been:

a) the initiation of institutional support programmes: funds for institutions rather than for projects or individuals; and
b) an increasing emphasis upon applied research, stimulated by the Daddario Kennedy Act of 1968, which specifically authorized the Foundation to support applied as well as basic research.

The institutional support programmes of the Foundation have been of two kinds: the Institutional Grants Programme and the Science Development Programme. The first was designed to overcome the intra-institutional strain resulting from the disproportionate development of certain of the university's research activities; the second the inter-institutional strain resulting from the very unequal distribution of resources between universities. (1) The Institutional Grants Programme was introduced in 1961 in order to provide some free funds to institutions in which the receipt of large volumes of project support for some activities may have been causing difficulties. The National Institute of Health (NIH) introduced a similar (General Research Support Grant) programme in 1962. All institutions receiving research grants from the Foundation were eligible, a condition which was subsequently broadened so that institutions participating in other of the Foundation's science education programmes could also participate. The maximum subvention which an institution could receive, on application, is based upon the amount of project funds received under the research grant and science education programmes, subject to a fairly modest maximum. Funds are used directly to strengthen the institutions' scientific activities: the purchase of equipment being the principal use to which they are put. The Science Development Programme was launched in 1965, corresponding to President Johnson's call to federal agencies to bear in mind the importance of "strengthening academic institutions and increasing the number of institutions capable of performing research of high quality" in awarding research grants. A similar view was emerging in the Congress, and in fact at the same time the Department of Defence introduced its project Themis with similar intent, and the NIH a comparable programme in 1966. The new scheme was seen as a policy of investment: investment in institutions potentially able to attain the status of "centres of excellence". Grants of up to $5 million were to be made available to a few selected institutions over a period of 3-5 years.

The selected institutions would have to have substantial resources, financial and academic, as well as carefully formulated institutional development plans. Great latitude has been allowed in the uses to which these funds may be put. In an early evaluation of the programme it appeared that funds were being sought overwhelmingly for expansion in the physical sciences, and scarcely at all in the social or biological fields. (2)

1. See John T. Wilson, "Dilemma of American Science and Higher Educational Policy", Minerva 9, 2, 1971, pp. 171-196. We shall have more to say on the nature of these "strains" below.

2. See W. Page, "The NSF Science Development Programme", in H. Orlans (ed.), Science Policy and the University, Brookings Institution, Washington, 1968.

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Criticism followed, since many felt that it had been wrong to focus so overwhelmingly on the relatively well off, the relatively successful. (The first universities to receive grants under the programme were all fairly well known, e. g. the University of Colorado, Duke University, Rutgers University, the Carnegie Institute of Technology.) The NSF admitted its difficulty in using the same criteria to judge between universities and the liberal arts colleges. (1) Subsequently, towards the end of 1966, two new programmes were introduced: a College Science Improvement Programme (offering grants of up to $100,000 for 3 years) "to accelerate development of the science capabilities of predominantly undergraduate institutions" and a Departmental Science Development Programme to upgrade selected areas of science and engineering at graduate institutions not already well known nor receiving the more general institutional grant.

Finally we must refer to the NSF's increasing concern with the application of science: less in the search for economic growth than for the solution to the pressing problems of American society. The RANN programme is the most obvious aspect of this concern.

We may summarize the arguments of this section as follows. We referred previously to the emergence and often rapid expansion of government agencies with a principal function of financing academic research on a project basis. The appropriateness of devoting substantial volumes of government funds specifically to such research, to be allocated in accordance with purely scientific criteria, and on a basis of "passive response" is being questioned in a number of countries: particularly in countries where such agencies have grown to a substantial size. A number of themes departing from this traditional policy have been distinguished. In France, CNRS policy has emphasized co-operation between research teams within different sectors or institutions; the orientation of academic research towards scientific areas felt to be particularly in need of development; the creation of centres of excellence outside Paris; and the harmonization of scientific and regional development policies. In Germany DFG policy has recently been directed at increased co-ordination of research in given scientific and geographical areas, and the development of selected fields of research not readily accommodated in traditional university structures and requiring substantial resources. The development of post-graduate education (Graduiertenförderung) has also been a theme of federal policy. In the United Kingdom policy has been aimed at the reduction of the share which post-graduate education has of educational and research resources, and the increasing orientation of research council support towards research areas of apparent economic or social importance. The SRC in particular is directing an increasing percentage of its funds towards pre-selected areas of science and towards specific institutions selected for their general quality. In all 3 countries policies have long had as a principal objective the stimulation of the full institutionalization of new areas of research, ultimately as new departments or institutes.

Finally in the United States there was mounting criticism of a federal project-support system which concentrated resources in so limited a number of universities and in a relatively limited number of fields of science. In the 1960's both NSF and NIH initiated policies designed, on the one hand to solve the problems faced by institutions frequently

1. A difficulty which the British Research Councils are now facing as a consequence of the growing size and status-consciousness of non-university post-secondary institutions (notably polytechnics).

unbalanced by a high volume of project research, and on the other to catalyze the emergence of centres of excellence outside the magic circle (in different institutions, hopefully in different regions). A recent theme of NSF policy (whether adopted willingly or by virtue of political pressure) has been a growing emphasis upon the utilization of scientific research in the search for solutions to national problems. Finally it goes without saying that the recent cut-back by such mission orientated agencies as NASA poses problems for academic institutions.

Not all countries have been forced, in part by the increasing political visibility of their growing research budgets, to depart from the traditional laissez faire policy of "passive response". But it is reasonable to assume that sooner or later they, in their turn, may be forced into reacting in similar ways to those described above.

In the following pages we turn specifically to the impact upon the academic system, first of the growth of project-funds, second of the departures from a laisser faire policy chronicled above.

IMPACT ON THE UNIVERSITY

A principal objective of project funding in its various forms has been the liberation of academic research from the restrictions imposed by the traditional university structure. Such restrictions may be of scale: universities may be unable to allocate the large resources needed for an individual project. Or, more fundamentally, they may be restrictions imposed by the structure of the university itself. The rigidity of traditional structures in Europe has been discussed too often to require space here. As, for example, the German Science Council has pointed out, innovation has often been inhibited by the chair/institute system which makes the development of new interdisciplinary research areas extremely difficult. The priority programme of the German DFG has provided the impetus for the establishment of new chairs or departments in many fields not adequately represented by the traditional institutes (e. g. crystallography, analytical chemistry, automatic control technology). Similarly, a principal criterion of the CNRS in establishing a new laboratory in a given field is that the field should be insufficiently developed in the universities and must require a special structure or considerable financial support. In the United Kingdom the Medical Research Council, in establishing its research groups, has been particularly concerned to stimulate the development of new university departments devoted to fields regarded as of national importance. Commitment of the university to such a development over a long period has been a pre-requisite of the creation of such groups.

To summarize, a major objective of Research Councils - particularly in departing from laissez faire policies in the direction of more active support - has been the stimulation of innovation in the universities. And, in retrospect, it is indeed the case that such funds have almost always been involved in the institutionalization of innovations in higher education. If one looks at the process of institutionalization of new sciences in the university (e. g. molecular biology, oceanography, radio astronomy) the importance of these external funds is apparent.

Project funds have also exercised a substantial effect upon the rapid development of postgraduate education - particularly at the Ph. D. and

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corresponding levels. (1) In countries in which research students are supported to a significant extent as research assistants, (see Table 4) the development of post-graduate work has been, in some measure, an unplanned consequence of the growing availability of funds. In times of serious scientific unemployment this may be a problem for individual students and for governments, rather than for academic institutions themselves. Nevertheless, whilst they must surely take note of these wider responsibilities, they must be aware of the consequences for themselves of any growing commitment to post-graduate work.

If one were able to categorize the innovations which have in fact resulted from the activities of these funding bodies, one would be focussed upon growth points in the body of scientific knowledge, whose development seemed to be in the interests of scientific advance or of national policy. Most would offer a reasonable chance of success. A certain conservatism, even in innovation, may follow from the fact that evaluations of "the interests of scientific advance" or of "national policy" are performed by relatively homogeneous groups. These groups are representative of the scientific elite rather than the scientific community, and of government rather than society.

A second line of criticism might run as follows. Innovation is rarely accomplished without disruption and innovation of this kind is no exception. Both the growing scale of project finance and the innovations deriving from more active policies recently adopted have had a number of possibly adverse effects.

The process of project funding is most developed in the United States, and even though American universities are by their very nature most open to innovation, and hence less easily disrupted, it is in that country that the problems have become most apparent. Moreover, because American academics have been more "self-conscious" than their European counterparts, analysis of the problem has been carried much further. Harold Orlans has attempted to assess the impact of federal funds (principally research funds) upon American institutions of higher education. He attributed the following effects directly or indirectly to the research funds:(2)

> "Federal Funds had probably accentuated the problems of the poorer institutions in hiring staff.
> The availability of large volumes of research money had effectively changed the nature of the academic scientist's job. Even though many institutions still wanted scientists to devote themselves wholly to teaching, fewer and fewer were prepared to do this. It has become less respectable to be a full-time teacher.
> There had already been a tendency to increase the size of undergraduate classes in the interests of economy and reduced teaching loads. Federal Funds had enhanced this trend, which had tended to

1. In "Postgraduate Education: Structures and Policies", op. cit., the sources of growth in post-graduate work were suggested to be:
   i) growth in student demand (whether through a positive attraction or the lack of appeal of jobs available);
   ii) the increasing specialization of knowledge;
   iii) the demand for scientists - via on the one hand the effect of market forces upon salaries, on the other of highly optimistic forecasts of national need;
   iv) the dynamics of the higher education system - the growing need for university teachers, the desire of institutions to "upgrade" themselves, and as a consequence of the growing availability of research funds.

2. H. Orlans, The Impact of Federal Funds on Higher Education, The Brookings Institution, Washington, 1966.

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reduce personal staff-student contacts. At the same time undergraduate teaching had become devalued at the great universities. There was an inverse relationship, in every major field and in each type of institution, between involvement in research and time spent on undergraduate teaching.

Moreover, the more able graduate students tended to prefer to support themselves with fellowships or research assistantships on federal grants. It is therefore the less able who inherit the teaching load of the absent professors, with an obvious impact on teaching quality. At the same time, and for various reasons, post-doctoral research associates tended to be little used in teaching.

The very different availability of funds between the sciences, the social sciences, and the humanities (reflected in salaries, teaching loads, numbers of post-graduate students, prestige, etc.) had created substantial strain in some institutions. Moreover, even within specific areas of research the emphasis of funding agencies on safe and on empirical work at the expense of more theoretical approaches (true also of the social sciences) tended to unbalance the research activities of departments. Problems of this kind were less acute in the liberal arts colleges, with little federal money, and in the really great, and often private, universities with enormous endowments and prestige. They were worst of all at the ambitious second-rank institutions which tended indiscriminately to accept project funds available in order to grow, and to attract top faculty.

Because policy towards the payment of indirect or overhead costs varied substantially from one federal agency to another, many academic institutions found themselves subsidizing the best supported areas of research at the expense of other less well-endowed areas.

Finally, because it was, or appeared to be, easier to obtain large research grants than small ones (and certainly the administration of large applications is easier) there was a tendency to inflate demand for funds beyond the requirements of the problem, and to 'empire building'."

Robert Nisbet(1) points out other, and in his view, disastrous effects of the growth of project funding. "I firmly believe", he writes, "that direct grants from government and foundations to individual members of university faculties, or to small company-like groups of faculty members, for the purposes of creating institutes, centres, bureaux, and other essentially capitalistic enterprises within the academic community to be the single most powerful agent of change that we can find in the universities' long history". To the growth of this funding he ascribes a number of pathological symptoms: the growth of sophisticated systems of financial management and cadres of professional administrators; the re-orientation of academics from a commitment to and involvement in their institution to a higher degree of discipline-orientation; and a reduction in the power of the teaching departments with their traditional systems of checks and balances. The man who can easily lay his hands on hundreds of thousands of dollars of research money goes where he will - where, for example, he need have negligible teaching commitments. Such entrepreneurs need have little concern with the traditionally laborious decision making structures of the academic community. Power and authority of

1. Robert Nisbet, The Degradation of the Academic Dogma, op.cit.

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the academic decision making structure are reduced, and the capacity of the institution to make coherent policy - involving links between research and teaching - is also reduced. The spread of the project system from the physical sciences to the social sciences and even the humanities, Nisbet ascribes to the corruption of affluence: "A veritable faculty jet set came into being, to excite envy - and emulation".

Outside the United States project funding has not developed to the same extent, research funds have been in no way as plentiful. Teaching has not been so downgraded as an aspect of the academic role as in some of the large American universities. What then is the relevance of this critique of the project system for the European universities?

Our initial reaction must be that such symptoms as the American university system demonstrates are unlikely to find their way to Europe. We may cite the following reasons for this view.

a) The scale of project funding has been nowhere so great as in the United States, and in some European countries very small indeed. This has a number of implications. In the first place the extent of development of a vast cadre of research associates has been inhibited. In the second place the extent of conspicuous consumption (the academic "jet set" syndrome) has not been so great in the physical sciences.

b) General budgets of universities have made some provision for research: everyone has had access to some research funds. Differences between institutions in the availability of research funds has thus been less. Special developments in research can, at least in principle, be funded through increases in normal institutional operating funds.

c) Project funds have come largely through Research Councils rather than through mission-orientated government agencies. The role of the NSF in the totality of project funds which have been available for United States institutions has been very much smaller than the roles of the British Research Councils, the French CNRS, the German DFG, etc. This has important implications. Bodies of this kind are not unconcerned with the effects of their activities upon the universities. They have been very largely concerned with the health of university science, and even in their now more activits phase, they are scarcely seeking to use the university for some wholly extrinsic purpose. Moreover, their activities almost everywhere span not only the natural sciences, but the social sciences and the humanities as well, even if, as in some countries these are the responsibilities of different research councils. Various discrepancies between the funds available for science on the one hand, and social science on the other, are unlikely to attain the size of the discrepancies in American universities. Policies, whether implicit or explicit, are likely to reduce any such divergencies.

d) European universities are not so competitive, one with another, as American ones. There are less inducements to be offered (in the way of salary differentials, reduction of teaching loads, etc.) which may serve to deprive the poorer institutions of most valued staff. (1)

1. Such competitiveness may have positive as well as negative effects. Joseph Ben-David in particular has seen it as an important source of strength for American science. See his Fundamental Research and the Universities. OECD, Paris, 1968.

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e) It is probably true in most European universities that academics are fairly evenly balanced in their commitments to research on the one hand, and teaching on the other. In British universities, though there are many who owe their principal loyalty to research, these are not in the majority. Indeed, in Oxford and Cambridge (with their overwhelming status in the British system) teaching is regarded as of very great importance. While this is so it is not meaningful to talk of any devaluation of teaching.

Can we then conclude that, while European universities may be much less innovative, much less effective as research-performers, than American universities, it seems to follow that they are immune to the diseases to which American universities have apparently been prone? In order to comment upon their future immunity, one must start by re-examining some of the relevant trends in scientific policy.

In many countries the rate of growth in research funds (from which project finance must come) has been falling. In relation to the likely numbers of university teachers in the coming years this reduction is especially obvious. However, against this must be set two other tendencies. The first is a pressure to which Research Councils (the NSF included) are responding: they increasingly emphasize areas of research pre-selected for their social and economic rather than scientific importance. The Research Councils' service to the academic system is being gradually eroded by a tendency to use them as instruments of broader governmental policy. The second trend, in the larger countries, is towards the concentration of resources in a limited number of centres (even if, as in France, this may represent a devolution from the status quo).

If carried to any lengths, such policies might have two major results. The first would be a clearer academic stratification system, with more pronounced differences between institutions. This is not a process of increased differentiation (in objectives as in structures) but an increase in stratification based simply upon affluence-deprivation. An increase in inter-institutional strain would inevitably follow. Stratification of this kind is rendered the more disadvantageous when one bears in mind the likely strains which would result within the favoured institutions. Concentration of resources is much more likely in the relatively expensive areas of physical and biological sciences than in the social sciences or humanities. It is therefore probable that in the institutions chosen as centres of research in the expensive fields, disparities between the affluence of these fields and the relative deprivation of the social sciences and humanities will be most apparent. Unless these universities are able to secure funds with which to maintain some balance between disciplines, it is possible that they will suffer from substantial disequilibrium. This must be avoided at the institutional level as at the national level.

Any complacency as to the continuing "integrity" or "communality" of the European university may be dispelled on the one hand by Halsey and Trow's conclusion that the status of the research component of the academic role in Britain is slowly rising vis-à-vis teaching,(1) on the other by the havoc which the student unrest of 1968 wrought within the university. An integrated social system is not so readily nor so overwhelmingly disturbed.

1. A.H. Halsey and M. Trow, The British Academics, Faber and Faber, London, 1971.

If there is one fundamental conclusion which follows from all this it is the need for the university to secure or retain the ability itself to formulate policy for its own development. Such formulations must be made in the light of academic considerations but without the inhibitions of traditional inflexibility. The weakness, as well as the strength of American universities, has derived from their immediate response to policies formulated elsewhere, and in response to a variety of needs. Thus the ultimate result of the project system, in the most extreme cases, has been a loss of the university's power to plan its own development, or even to attempt to maintain any sort of equilibrium. Of course it must be noted that in some countries universities have never had this power. In some instances this may have been due to the subordination of the institution to regional or central government (much more true of non-university post-secondary institutions), in others to the complete autonomy of the individual institutes. Recent reforms in France for example ought to have, as one of their results, the effect of increasing the power of universities themselves to initiate and implement comprehensive plans. Proposals for reform in Japan, too, have been aimed on the one hand at increasing the autonomy of the universities, on the other at decreasing the power of the traditional chair-holders.

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IV

MASS INSTITUTIONS: NEW APPROACHES TO RESEARCH

Much of the recent thinking in the higher education field has been devoted to a consideration of the appropriateness of existing educational structures. In most OECD countries post-secondary education has been provided by two kinds of institutions: the traditional, elitist, largely non-vocational universities on the one hand, the new vocational institutions established to cater for the more technical manpower needs of the economy on the other. The former tended to offer long courses, the latter much shorter ones. The former tended to be characterized by restricted channels of access: largely through specific types of academic secondary schools. Education in the former is very much more expensive, thanks both to better staffing ratios, and the provision which is always made for the research activities of staff. Mobility, both of staff and of students, between the 2 kinds of institution (the sometimes termed "noble" and the "less noble") has been very limited.

An OECD report (1) criticized the appropriateness of this traditional structural map on a number of grounds:

a) Lack of diversity: the existing systems offered small numbers of access-routes; a very limited number of patterns of study (duration, methods of attendance, types of qualification), limited numbers of fields of study;
b) Inefficient utilization of resources;
c) Inability to innovate. The rate of diffusion of innovations introduced in one institution through the system has been exceedingly slow. Innovations introduced by the "less noble" institutions have tended to be ignored by the "noble" ones. Indeed, many innovations of the former have been directed towards imitation of the more prestigeous universities, and there has been relatively little attempt at creating separate identity.

It is not difficult to find in almost all countries a hierarchy of prestige among academic institutions, very apparent to those involved: in the United Kingdom, Oxford and Cambridge, in France certain of the "Grandes écoles", in Japan, Tokyo and Kyoto Universities, in the United States some 20 or so universities largely on the East and West coasts, and so on. The prestige of these "top institutions" may be based on tradition, location (e.g. Paris), or on other factors: frequently it is at least highly correlated with the amount of graduate work and research carried out, although the "Grandes écoles" are an exception. In the United States,

1. "Towards New Structures of Post-Secondary Education", OECD document, Paris, 1971.

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for example, Consolazio found linear relationships between three important contributants to academic prestige: general income, research income from Federal sources, and the number of doctoral degrees awarded in science and technology. (1) This conclusion is supported by the National Science Board's study of graduate education. That study also found that the same indices also correlated well with undergraduate quality (liberal arts colleges excluded), defined in various ways. (2) Because of these relationships, the initiation and expansion of post-graduate and research work has been an important means of institutional advancement up this one-dimensional hierarchy. Institutions officially denied research facilities for post-graduate students have frequently resented what appeared to be unjust curbs on their legitimate aspirations.

New thinking in higher education is thus very substantially characterized by the attempt to replace institutional hierarchy by institutional diversity, to replace differences of quality by differences of function and approach. This is one of the objectives of the restructuring of Japanese higher education proposed by the Central Council for Education. The Commission on Post-Secondary Education in Ontario (Canada) which recently reported, based its recommendations on principles of increasing diversity of institutions, increasing flexibility, and increasing ease of transferability. How should research, the traditional prerogative of the university, be accommodated in the new structures? This section of the paper will describe policies being adopted and implemented in four countries, referring particularly to:

a) the rationale behind new institutions being established principally to cope with student expansion;
b) new approaches to the institutional role of research, largely to be found in these new institutions;
c) the way in which research activity may therefore be divided between traditional universities and the other institutions.

NEW STRUCTURES IN DENMARK

(Integrated Comprehensive University Model)(3)

In 1963-64 it became clear that the expansion of Copenhagen and Arhuis Universities would be inadequate to cope with the probable expansion in student numbers. (Remembering that Danish universities do not have restricted admission policies.) It was therefore decided to establish a medical faculty in the town of Odense. When it subsequently became clear that other faculties would also be needed, the proposal was made that a third university should be founded, not necessarily on the traditional model. In 1966 the necessary law was passed, and a so-called University Centre was established at Odense with faculties of medicine and humanities. It was decided that integration with other sorts of post-secondary education in the area should be initiated. Development has been slow, but some integration with the College of Commerce, with a school of social work, and in the training of physical education teachers, has come about.

1. W. Consolazio, The Dynamics of Academic Science, National Science Foundation, Washington, 1967.
2. Graduate Education: Parameters for Public Policy, National Science Board, Washington, 1969.
3. Cf. "Towards New Structures of Post-Secondary Education", op.cit., pp. 39-41.

In 1970 the decision to found further university centres at Roskilde and Aalborg was taken, with the possibility of a further centre being founded later. Aalborg and Roskilde were to prove somewhat different from Odense. In the latter the university had become pre-eminent, and the problem was securing the integration into it of the existing non-university educational institutions. In Aalborg there were well-established technical teacher training, social work, music and engineering colleges already in existence. At Roskilde there was previously no institution of higher education: this made the formation of a new type of comprehensive institution somewhat easier. The education offered is of a problem-orientated kind, with little formal lecturing. An important aspect of Roskilde philosophy is the integration of research and teaching: all this is discussed further below.

The basic University Centre concept is founded upon the integration of academic and non-academic post-secondary studies. The main reason why this was thought desirable was the previously extremely high drop-out rate from universities (about 50%). Some of these students found their way into other faculties of the university, others into non-university institutions such as teacher training colleges. Since these other institutions tended to have restricted entry, it was possible that a high proportion of their new students were university drop-outs. But the exact figures were unknown. It was therefore intended that transitions between these different types of study should be facilitated by the restructuring of higher education, and should not entail a possibly wasted one or two years. Whilst cost considerations were certainly relevant to the new structures proposed, these were not principally based upon economic arguments.

It is interesting to look into the reasons for this high drop-out rate. It is not principally due to examination failure (for example the Technical University has a very high failure rate in examinations, but a low drop-out rate). It is in fact a positive decision on the part of students that vocational education would be more useful to them. The pressure of demand for shorter post-secondary education courses has been increasing rapidly, notably in the teaching, social work, librarianship and medical auxillary professions. (Interestingly this is not likely to be an expansion of female demand for higher education, since these are not predominantly female professions in Denmark.) The possibility that a surplus of university graduates may be in course of production may have affected the changing pattern of demand for higher education. Until now the career chances for graduates have been extremely good, a very high proportion of university graduates (with the exception of lawyers and economists) having gone into the public sector. Degrees have hitherto commanded very high salaries and very high status. But future expansion of the public sector is likely to be at a reduced rate, since the government has a general policy of reducing expenditure.

The first attempt to draw up an integrated long term plan for all post-secondary education has recently been made. It was unlikely that the traditional universities would expand much over the coming years. The anticipated expansion would be accommodated principally in short-cycle post-secondary education, both inside and outside the new Centres. University academics were quite happy with this development, and have indeed been pressing for limits on university expansion. (They may have been unaware that a static university system could imply staff reductions, and little scope for innovation.)

In this section we shall describe certain aspects of the University Centre at Odense, referring particularly to the problems of integration, and the nature and role of research. The experiment at Roskilde raises

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somewhat different issues, and from the point of this paper is more usefully described in section V below.

Integration of the previously non-university institutions into the Odense Centre has proceeded slowly. There are a number of reasons for this. First, these various institutions were directly responsible to a variety of ministries (e. g. Social Affairs, Health, Culture) or to various branches of the Education Ministry. The whole process was necessarily extremely bureaucratic. Second, many of the institutions were fearful of losing their traditional identity and had begun to obstruct the implementation of the integration policy. Third, there were substantial differences of conditions of work, salaries, between the university and non-university sectors. Fourth, the views of the relevant professional bodies were equivocal. What would be the relative standing of supposedly equal professional practitioners, some of whom had had a university education, and others of whom (from non-integrated schools) had not?

Given the hitherto slight integration, and these difficult problems, it is perhaps not surprising that there has been little expansion of research into the fields of study newly incorporated into the university centre. This of course is what we might expect to be the ultimate result of the unification process: the gradual equalization of the roles of teachers in what had previously been university and non-university segments of the Centre. In fact little thought seems to have been given to this problem so far, and there have been no planned attempts at establishing the education in the more professional areas on a more research-intensive basis. Research in the traditionally university areas is acknowledged to be in no way different from traditional university research. There have been ample funds for research, but no research policy. Work has been of an individualistic kind, with no particular attempt to relate it to local needs.

It is necessary finally to say a little about the views of the Research Councils. In the first place, the Research Advisory Council feels that the balance of research cannot be allowed to develop solely as a result of the expansion of teacher numbers, but that it should reflect explicit national priorities. Research proposals should be more generally scrutinized by expert committees of scientific peers, which could best be done if a very much higher percentage of university research were financed on a project basis. The staff of universities should automatically receive funds only for that research deemed necessary for their teaching. There is little doubt that this proposal has had a mixed, though not wholly antagonistic, reception among the scientific community. So far as the development of research in the new centres is concerned, the Research Advisory Council had not been involved in the planning of the centres, nor had they formulated any specific policy towards research in them, or the encouragement of research in the lower level institutions now amalgamated into the centres.

THE "INSTITUTS UNIVERSITAIRES DE TECHNOLOGIE" (IUT's) IN FRANCE

(Combined Development Model) (1)

Higher education in France is traditionally characterized by the division between university faculties and the large range of "Grandes

1. Cf. "Towards New Structures of Post-Secondary Education", op. cit. pp. 39-41.

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écoles", of widely varying standards and directed by many of the central ministries. Entry to these schools (which range from the great Paris institutions such as the "Ecole polytechnique" and the "Ecole normale supérieure" to a wide range of provincial engineering schools) is highly competitive, on the basis of an entrance exam taken after the baccalaureate and 1-2 years in a preparatory class. Essentially, whilst the university faculties were responsible for the education and training of teachers and researchers, the schools trained specialists to meet the specific needs of industry and commerce. The defacto elitism, educational and social, of the "Grandes écoles" is well known. On the whole research in these schools has been very restricted: few have substantial research programmes.

The reforms of 1966, which did not affect the "Grandes écoles", were in part designed to give further emphasis to the vocational function of university studies. Into the arts and science faculties they introduced the concept of "cycles" of study: the 2 year first cycle leading respectively to the diplomas DUEL (arts) or DUES (sciences). This could then be followed by a one year second cycle leading to a "licence" (an essentially professional degree qualifying the holder to teach in secondary schools) or a 2 year second cycle leading to the degree of "maîtrise" (intended for those considering a career in research). Valuable though those innovations were, they did not profoundly affect the structure of the French universities. (1) The reforms of 1966 also led to the establishment of a new type of institution: the "Institut universitaire de technologie" (IUT). These were set up as institutes of the university, with the intention of diversifying the kinds of higher education available and specifically with the function of providing a type of training intermediate between the technical baccalaureate and the courses of the university and the "Grandes écoles". Admission is essentially by possession of the "bac" although students without it may be admitted after passing an entrance examination. Unlike the majority of faculties, the IUT's operate a strict numerus clausus. IUT's are divided into departments (e.g., the various branches of engineering, chemistry, data processing, business management) and students study for two years before taking an examination leading to the "Diplôme universitaire de technologie" (DUT) in the special field chosen. It is then possible to seek transfer to another university faculty: the DUT being counted as equivalent to the first 2 year cycle of study there. It is also possible, in some places, to transfer after DUES for a one year course in the IUT leading to the DUT. (2)

Before going on to say something more about the IUT's, we must say a little about the effects of the 1968 "Loi d'orientation", unclear though these may as yet be. A major objective of the 1968 reforms was the aboli-

1. A new decree was issued in March 1973 introducing important reforms in the first cycle of university studies and creating a new national diploma "Diplôme d'études universitaires générales" (DEUG), awarded after completion of the first two years of study. The reform is said to have at least two main objectives, namely to ensure a larger diversification of higher education and to reduce the inefficiency of university studies (50% of new entrants to French universities "drop-out" without receiving a degree which qualifies them for employment). The DEUG will replace the former DUEL and DUES.

2. The first of these transfer processes is very much the more common. A recent inquiry has shown that for 38.5% of students, graduation from an IUT did not represent the end of studies. Of those who were currently studying 21 months after graduation, 29% of male and 45% of female students had entered another UER of the university. [See Centre d'études et de recherches sur les qualifications, Note d'information No. 10 (20th August 1972)]. In contrast in 1972-73 only 483 students transferred from another UER to an IUT.

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tion of the old faculties, and the creation of "Unités d'enseignement et de recherche" (UER's). The faculties were said to have had too much independent power and their educational outlook was criticized on the grounds that it was compartmentalized and conservative. The new organisation of the universities was intended to strengthen their position as a corporate unit capable of developing a comprehensive policy. It is as yet unclear to what extent UER's are simply departments renamed, and to what extent they may represent wholly new approaches to structuring the university.

Under the old system the IUT's were university institutes, but the universities at that time were no more than an administrative framework, offering no guidelines of policy to largely autonomous faculties and institutes. In the light of the reforms, the IUT's were reconstituted as UER's of the universities, but with a larger measure of direct state control over their establishment, structure, courses, than is otherwise the case. Unlike the budgets of other UER's, which are determined by the university in the light of its total allocation, IUT budgets are determined centrally by the ministry. They also differ from other UER's in the strict numerus clausus which each operates: no IUT department may recruit a cohort of more than 150 students. Finally they differ from other UER's in the recruitment of teachers, and in the lack of provision for research. Teachers are appointed to IUT's in a different way from other university teachers, and many of them are appointed on a part-time basis from industry. They may feel, and be regarded, as second class citizens in universities, partly because it is not intended that any research be carried out in the IUT's. (This specific policy may be contrasted to the lack of policy with regard to research in vocational institutions integrated into the Danish university centres.)

There were two main reasons for this policy. The first was financial. At the time of establishment of IUT's there had not been enough money simultaneously to construct the necessary buildings, introduce all the new posts necessary, and make provision for research. The second reason was the intention that IUT faculty have wide outside links. Certainly they could participate in the research of other UER's (in which they could also teach). But most IUT's had been established in towns with some local industry. It was intended that IUT faculty would be interested in the problems of this local industry, and hence that their interests in research would also be relevant to the industrial problems. They were therefore to be encouraged to seek to carry out their research in the laboratories of local firms or of nearby government research establishments.

However well known its rationale among French scientists, this policy of excluding research from IUT's seems to have worried many. For the staff to have to carry out their research in another, and perhaps distant, place seemed wasteful of time. Scientists liked to be able to visit their laboratories briefly at any odd moment. Moreover it was the IUT's which were growing most rapidly (though less so than intended). (1) Many were worried that the example might be followed in other places, and that soon there might be many UER's with no provision for research. According to some opinion in the French scientific community, "the professor who doesn't want to do research shouldn't be in the university, but in the lycée". Many French universities are fearful lest

1. The IUT's grew from 1,678 students in 1966-67, to 17,287 in 1969-70, and to 31,985 in 1971-72. (A further 20,000 were studying elsewhere for their higher technician's diploma. Thus 7% of all post-secondary students were following short-cycles of study, compared to 25% envisaged by the Ve Plan.)

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the traditional view that university teaching can only be carried out in conjunction with research be gradually displaced. There is of course an alternative view. Others argue that it cannot be assumed either that professors are by definition good researchers, or that by educating 20-40% of an age group in an intellectually stimulating research-intensive environment the needs both of individual students and of society would be met.

So far as the needs of research were concerned, one could not expect the same individuals both to solve the fundamental problems of society, and at the same time to teach the most elementary science. There were too many "pseudo foyers de recherche". According to this opinion, the teacher in higher education had to be able to offer his students both a period in which to reflect, and a diploma securing access to a profession. To do this he had to be kept fresh, (and some sabbatical time for research could be part of such refreshment), in touch with the problems of the young, and kept from becoming a "grand patron". He also needed some understanding of the economic system in which academic diplomas had their value. The teacher should be judged by the appeal of his teaching for students and by their success, rather than by his research papers. It is doubted by some whether the teacher's role, thus conceived, is compatible with a real commitment to research. Some therefore argue for a much greater separation of undergraduate teaching on the one hand, post-graduate work and research on the other. This might be in two entirely separate structures. Alternatively in place of the UER's there might be separate sub-structures for education on the one hand, research on the other, within the university, with individual members of staff receiving joint appointments within this dual structure.

NEW STRUCTURES IN ENGLAND AND WALES

(Binary Model) (1)

Post-secondary education in England and Wales has traditionally been based in three kinds of institution: the universities, teacher training colleges, and further education colleges. Development of university-level work in the further education colleges was stimulated by a government White Paper of 1956 listing 24 colleges as particularly appropriate for such work. Subsequently the government announced that degree-level work would be further concentrated in only 9 institutions - known thenceforth as Colleges of Advanced Technology (CAT's). (2) These were to shed their lower-level work and (largely) their facilities for part-time work, and to concentrate on full-time degree studies. The remaining 15 colleges, initially designated, were to be Regional Institutions (rather than national or purely local), with a commitment to a mixture of degree level and other work, and to both full-time and part-time studies. (3) A National Council for Technological Awards was set up to inspect and supervise degree-level work in the colleges, to establish syllabuses, and to award the degree-equivalent qualification of Dip. Tech. This was replaced by the Council for National Academic Awards (CNAA) in 1964,

1. Cf. "Towards New Structures of Post-Secondary Education", op. cit., pp. 39-41.
2. Based largely on Eric Robinson, The New Polytechnics, Penguin Books, 1968.
3. See, for example, Tyrrell Burgess and John Pratt, Policy Into Practice: The Colleges of Advanced Technology, Allen Lane, London, 1969.

on the advice of the Robbins Committee, with the right to award full degrees - B.A., B.Sc., etc. It was also as a result of the Committee's recommendations that the nine CAT's were ultimately given university status and autonomy. The other colleges, including the 15 Regional Colleges, were left under the jurisdiction of local authorities.

In 1965 the view that post-secondary education should continue to be provided on a "binary" basis ("private" universities and "public" colleges) was given specific ministerial backing. Then, in 1966, a government White Paper was published proposing the incorporation of some 60 colleges (of technology, of art, of commerce, etc.) into 30 new "polytechnics". All the 15 regional colleges were included in what was to be the elite segment of non-university post-secondary education. In contrast to the earlier designation of the CAT's the polytechnics were to retain part of their non-degree level work and their provision for part-time study, and they were not intended so exclusively to concentrate on technological fields. In these ways, and in others (lack of autonomy, control by local authorities, inability to award their own degrees) the polytechnics were intended to differ from the universities. Students in the polytechnics would increasingly work for the degrees of the CNAA which, by its careful surveillance, ensured the quality of staff and facilities, and the integration and planning of the syllabi. In considering the past and future development of the various polytechnics two important factors must be borne in mind: the enormously different positions from which they began, and the varying autonomy granted them by the local authorities to which they are responsible.

The 1972 White Paper on Education suggests that future post-secondary expansion will be concentrated in the non-university institutions, and particularly in the polytechnics. By 1981-82 the universities are expected to expand from 236,000 to 375,000 students, the non-university sector (full-time and "sandwich" work) from 227,000 to 375,000. Within this latter total the polytechnics are expected to expand from 66,000 to 180,000 (or from 14% to 24% of the total).

We turn now to a consideration of research in these polytechnics: the current scope of their activities and the plans which they are making for accommodating research in their future development.

In 1967 the then Secretary of State for Education and Science set out the government's views on the performance of research in polytechnics:

> "The main responsibility of the Polytechnics will be as teaching institutions, but it will be necessary to make the provision for research which is essential to the proper fulfilment of their teaching functions and the maintenance and development of close links with industry, particularly local industry, so as to promote the rapid application of results to its problems."

In other words research was to be carried out only in so far as it contributed either to teaching or to the needs of industry (and particularly local industry).

The table on following page gives some indication of the scope of research activity at present.

Thus about half of the staffs of most polytechnics are technically equipped to carry out research. In practice it is rare to find more than one third actually involved. The provision made for such work in terms of money (whether from general funds or from contracts), relief from teaching duties, etc., varies enormously. Research budgets range from less than £20,000 per annum in some of the smaller institutions to around £200,000 in some of the larger ones. Some departments, particularly in

RESEARCH IN POLYTECHNICS
(classified by size in 1972)

NUMBER OF POLYTECHNICS	AVERAGE NUMBER OF ACADEMIC STAFF	AVERAGE % WITH HIGH DEGREES	% WORKING FOR HIGH DEGREES	% CARRYING OUT POST-DOCTORAL RESEARCH OR SIMILAR
4	200-299	31	14	17
6	300-399	35	17	21
8	400-499	35	12	21
6	500-599	33	12	21
3	600-799	37	15	21

the social sciences, have no past tradition of research whatever. Many of the older staff members have never done any research, and the research by younger ones is directed towards attainment of a higher degree. By contrast, in some polytechnics it is not difficult to find departments (especially in the physical and engineering sciences) which differ scarcely at all from some university departments in the scope of their research activities. Thus, in many polytechnics research is concentrated in a limited number of departments. In extreme cases there may be a single department which, by virtue of its traditions, has world-wide connections, substantial R and D and consultancy activity, and an over-subscribed post-graduate course - in a small and mediocre institution. Such situations may cause substantial internal strain.

All the polytechnics seem anxious that the expansion of post-graduate work should figure prominently in their future development. They differ substantially, however, in how they feel this should be done, and in the extent to which they see their activities as clearly different from those of universities. But the point we wish to emphasize here is this: the polytechnics are thinking seriously about the role which research should play in the spectrum of their activities. Many are seeking to develop specific policies towards research, whether at the level of the individual department or of the whole institution, and many are anxious to avoid simply responding to opportunities as they arise. There are a number of relevant themes widespread in the thinking of those planning polytechnic development.

Research is necessary to attract good staff, but it also has a more important relation to teaching. There is a need to broaden the outlook and maintain the freshness of staff: research has to be seen as one aspect of a comprehensive staff-development programme. Some provision for research, not necessarily of an expensive kind, must be included in such a programme: so must time and expenses to attend conferences, study-leave, library facilities, etc.

Research projects should not be determined solely by the individual interests of academics, but should reflect departmental or institutional priorities. There should be much more association of staff in group research projects, particularly of a multi-disciplinary kind. This reflects the group planning of courses which CNAA surveillance requires, and is again in distinction to the universities traditionally individualistic ("lehrfreiheit") approach.

Research projects should be geared to the solution of "real" problems: not only of industry, but of the community. Research in the social fields, as well as the technological ones, should be application-oriented. "Action-research" would fit in very well. This of course requires that the staff set about selling their services to potential users. There are, however, differences in the extent to which it is felt activities should be directed specifically at the problems of local industry.

Another issue being debated is the relative benefit of concentrating research resources in departments which are already doing good research as compared to attempting to develop it in all departments. Further, should research activity and advanced study perhaps be concentrated in a single institute, covering all disciplines, and to which members of staff might be sent for period of time?

There is little doubt that in implementing ideas of these kinds the Polytechnics face substantial difficulties. Their systems of government are frequently restrictive, leaving their directors with little authority vis-à-vis local officials, and yet with rigid internal hierarchies denying any voice to junior staff. Some local education authorities are as yet little aware of the real differences between the new polytechnic and what was to them, for so many years, the local technical college. Staff may lack contact with local industry or local social/community organisations. Indeed, industrialists may often prefer to take their problem to a more prestigeous university department, even if it may lack any real commitment to applied research. There may be a real conflict between the need to be entrepreneurial (to build up a substantial volume of applied research), and the desire closely to link research projects with teaching. Any attempt to formulate institutional research policies, let alone to co-ordinate or even centralize research, may be obstructed by heads of department who see it as an infringement of their authority.

It is uncertain to what extent individual academics will be prepared to subordinate their own interests to the institution's needs and priorities in research. Many of the more radical social scientists (who may have been attracted by the polytechnics' non-elitist philosophy) seem to resent the need to do research commissioned by local social service agencies whose ideology they may dislike. Finally a number of polytechnic teachers consider that the Research Councils, and above all the Science Research Council are biased against them. The SRC's "centre of excellence" policy, for them, seems designed largely to inhibit the development of their infant research ambitions. Research Council committees have been criticized by polytechnic faculty for their emphasis upon strictly "academic" criteria in evaluating research proposals from polytechnics. The Councils have been concerned to establish whether or not such applications should be judged by the same committees, and in the same way, as applications from university scientists. Both the SRC and the Social Science Research Council have set up study groups to examine this issue.

Perhaps a major reason for the relatively small number of applications made, and for their rather high failure rate, has been a lack of expertise in such matters within polytechnics: expertise relating simply to the feasibility of carrying out and organising large projects, of formulating proposals, and so on.

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In our view the job of these Councils is largely to support what may be called basic research, and for reasons discussed earlier it could have serious repercussions if considerations of external benefit were to weigh over-heavily in their evaluations. If the polytechnics are to concentrate their efforts in the applied research areas it is to potential users that they should largely turn for research funds. The role of SRC and SSRC in funding their research should be much more limited than is the case with university research.

RECENT DEVELOPMENTS IN NORWAY

Prior to the late 1960's higher education in Norway was characterized by a sharp differentiation between the university sector (offering a long academic education in traditional faculties), and a variety of short-cycle colleges specializing in the usual vocational areas. There was little mobility, either of staff or of students, between the two sectors, and studies in the colleges could not be credited towards a university degree. The technical colleges were mostly very small, centrally administered, and lacking in autonomy. In 1970 the universities of Oslo, Bergen, and Trondheim had enrolled 30,000 students: by contrast, there were 10,000 students in about 50 short-cycle colleges (which operated a strict numerus clausus). Moreover, there was little flexibility of access to either part of the system.

A Royal Commission on Higher Education (the Ottosen Committee), appointed in 1965, collected data which demonstrated the increasing popularity of the short-cycle colleges with secondary school graduates. In 1963, 60% of those entering post-secondary education went to universities and 40% to other post-secondary institutions; in 1969 these figures were 50% and 50%, even though the acceptance rate for the non-university sector fell substantially. (1) There was thus clear evidence that the university faculties increasingly represented a second choice for secondary school graduates. It has been suggested that the short multi-disciplinary vocational courses were seen as more valuable: particularly by working class students. The very real differences between urban and rural Norway must also be recognized. The universities, situated in the largest urban centres, may be seen as relevant principally to the urban situation - by virtue both of geographic accessibility and of their activities both in teaching and research. Sørheim has written:(2)

> "A criticism that seems well-founded is that the research activities in universities have been predominantly urban-oriented. Social research has shown very little interest in the serious problems of the small rural communities, where rapid decrease in the primary activities of the sector (due to technological change and other factors) is threatening the communities with emigration and eventually a total collapse."

Stimuli to reform were also provided by an appreciation of the very substantial potential for growth in post-secondary education (es-

1. It is forecast that the percentage of all post-secondary students enrolled in universities will fall from 73% (1972) to 62% (1988).

2. I. Orbeck Sørheim, "The Norwegian Regional Colleges" in Short Cycle Higher Education: A Search for Identity, OECD, Paris, 1973.

pecially if equal opportunity was to be offered to students from the rural areas), and of the lack of capacity for innovation in the small and isolated short-cycle institutions.

To cope with these problems two initiatives were taken in the mid-late 1960's. First, it was decided to establish a new university in the very north of the country (at Tromsø). Second, a network of new institutions (regional colleges) was to be established.

The principal reason behind the establishment of Tromsø, the most northerly university in the world, was the attempt to assist the development of the region. In all its policies and activities the new university seeks a balance between regional needs and the cosmopolitanism necessary in a national (university) institution. Thus, in the light of the region's acute shortage of medical personnel, it was in the area of clinical medicine that the university began its work (1968). The first 330 under-graduate students arrived in August 1972: a figure which is expected to rise to 3,500-4,000 by 1980. This expansion has been planned not only in the attempt rapidly to produce as many additional university places as possible, but also in the light of the anticipated absorption capacity of the area. It was seen as essential to preserve the social and industrial infrastructure, and to seek to create a regional demand for graduates. Moreover, the spending of the university would have a significant effect upon the regional economy, especially as there is a deliberate policy of spending in the north where possible. Of the 1972 enrolment about 80% of students are from the north of Norway (equivalent to some 50% of all northern students attending university). Recent forecasts have, however, led to the view that it will eventually be necessary to recruit some 40% of students from the south if planned expansion is to take place.

It is interesting to inquire into the reasons for which staff, largely young and idealistic, have been attracted to Tromsø: certainly there has been no problem in recruitment. There are perhaps three reasons. Some have been drawn by their own regional roots (such ties can be very strong in Norway); some felt that the chances of an eventual Chair were rather greater than elsewhere; others were attracted by the possibilities of academic innovation, restricted elsewhere. Certainly the university has sought to depart from traditional lines. It has departments in the place of traditional institutes. Studies are designed to be flexible, blending practical experience with academic study where possible: in medicine, for example, the traditional distinction between theoretical and clinical work has been blurred, and students deal with patients from the beginning.

Turning now to the research plans of the university, we find that there are three major themes: an emphasis upon planned group research; the attempt to balance regional relevance against scientific respectability; and a democratic approach to problem-choice.

Research is to be largely organised in groups - which will be renewed or re-arranged as projects are completed. New staff will be expected to fit into one of their department's current interests - in contrast to the usual lack of any such obligation. Groups work upon issues chosen both for their scientific interest and for their local relevance: a condition of which most applicants for jobs are aware, since it has been widely publicized. Thus, whilst the interests of scientists are highly relevant, other factors are also taken into consideration, and proposed projects are widely discussed by academic staff (and in some cases by students and non-academic staff also) in the department. In physics, for example, each research group formulates its proposals, and subsequently the whole academic department determines priorities in the allocation of resources. Whilst in that field local relevance is a less readily applicable criterion than in the social or biological disciplines,

nevertheless many Tromsø physicists would like to see the establishment of a local electronics industry with which they would work. They are not unaware of their local obligations.

In spite of its regional commitment, Tromsø is very definitely a university: with a large range of subjects, professors, and a clear commitment to research. It has good relations with, and representation on the Norwegian Research Council (NAVF), which was, moreover, prepared to make special travel allowances so that research personnel would not be financially dissuaded from going to the north.

The situation in Norway's new Regional Colleges is somewhat different. These were created, as we have already indicated, to cope with the increasing demand for relatively short post-secondary education, yet within an innovative organisational framework. For two reasons, the new Colleges were established de novo, rather than by amalgation of existing colleges. On the one hand the Ottosen Committee had been concerned by the rigidity and authoritarianism of the vocational colleges. On the other, it was felt that innovation could proceed more rapidly without the need to overcome any opposition and to resolve problems of staff differentials. Political commitments required rapid progress. We should point out that the inadequacies of the older structures (of scale, structure, etc.) are widely recognized, and future integration with the new Regional Colleges is under discussion.

The first Regional Colleges were established in Norway's fifth and sixth largest towns (Stavanger and Kristiansand), on the assumption that these would provide adequate pools of potential students. But subsequently the opinion that future Colleges should be located outside the urban centres gathered momentum. Gradually they came to be seen as a potential instrument of regional development. Thus, the second two Colleges were placed in under-populated areas: these soon established themselves as focal points for students from rural Norway. There are now 7 Colleges; another 7 are planned.

In what significant ways do the Colleges differ from pre-existing university and non-university institutions? First, their courses of study are rather different. Most last for two years and most of the Colleges offer both broad, rather academic courses, which could lead on to university education as well as more specialist vocational courses. (Thus, for example, the Nordland Regional College at Bodø offers academic courses in languages, physics, mathematics and chemistry; specialist courses in regional economics, marketing, quantitative methods systems analysis and data processing, and accountancy.) Professional studies tend to be broader than in the older, smaller, institutions, and most include 15-25% of "allmenfag" - courses designed to set the professional studies in a broader context. Frequently new approaches to specific areas of study have been designed: in pedagogics, for example, the College at Lillehammer focusses upon social aspects of education rather than (as is more usual) upon its psychological aspects. Methods of study may also differ.

Thus at Lillehammer again, the students have no reading lists of set books - only lists of critical problems, upon which they may inform themselves in any way they prefer. Practical work is usually an integral part of the studies, and a dissertation (often upon a problem of local importance) is frequently required. The Colleges have other important characteristics. They are required to devote some 25% of their resources to providing short refresher courses for adults. Emphasis is given to the admission of a certain percentage of students without formal examination qualifications. There is widespread use of part-time teachers from local industry and service organisations. The regional issue is of considerable importance: reflected both in the courses of study offered, composi-

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tion of governing boards, and the energetic attempts the Colleges are making to "sell" themselves and their products to their local communities.

There is no doubting their attractiveness to students. In 1969, 150 students were admitted from 200 applicants: by 1972 these figures had risen to 1,350 and 3,650 respectively. It is nevertheless a fact that some of them have had difficulties in recruiting suitable staff - who must be not only as well-qualified as university teachers, but must possess also an orientation to practical problems.

We turn now to the place of research in the Regional Colleges, bearing in mind the fact that they have necessarily been pre-occupied with teaching-development hitherto. It is the Ministry of Education's view that the Colleges should carry out research, but not that requiring the provision of expensive equipment. Moreover the research should develop in the light of the Colleges' essentially educational and service functions. Research has to be seen as one aspect of staff development and as an aspect of their service to the local community. There is substantial interest in building up consultancy on behalf of local organisations, with which students could often be associated. It is left to individual institutions to determine the number of man-hours of staff time to be devoted to research, and how these should be distributed. Staff of the Colleges may seek outside research funds. Telemark College at Bø, for example, has a research contract from the Environment Ministry. As far as the Research Councils are concerned, NAVF made no grants for research to the Colleges in 1972. It is important to note that this was not the result of any policy-decision: there is as yet no specific policy, and the question of whether different criteria should be used in evaluating proposals from the Colleges has not been raised. It is possible, however, that in the future the Council may seek actively to encourage the participation of staff in research, perhaps by association with university research projects or university teachers, or by making funds available so that staff can be allowed time off to do research within a university.

CONCLUSIONS

The Norwegian Regional Colleges and the British Polytechnics are rather similar attempts at dealing with certain problems outside the university. These problems include the expanding demand for post-secondary education; the need to provide increasingly diverse kinds of such education and channels of access to it; and the traditionally non-innovative nature of non-university institutions. Each of the structural innovations we have described is likely to be the fastest growing segment of post-secondary education in its particular country: partly as a result of government policy and partly as a result of the apparently increasing attraction of shorter and more vocational courses to students. (1)

All the institutions described (except Tromsø) offer these shorter and more vocational courses, although the Polytechnics and the University Centres also offer straightforward academic degree courses as well.

1. There is recent evidence of decreasing interest in university education on the part of eligible British students, although it is not yet clear whether this is a swing towards Polytechnics.

They are of particular interest here because of their increasingly important place in the general plan of post-secondary education; because their activities and plans represent specific attempts at assessing the proper place of research in their activities; and because it will ultimately be of considerable interest to determine the effect of teaching vocational subjects in an increasingly research-intensive milieu.

Three themes in the actual and planned research activities of these institutions stand out: the formulation of institutional plans, priorities, and policies in research; the role of research as one aspect of staff development; and research as one aspect of the service function of the institutions. Excluding the University Centre at Odense (but including that at Roskilde and some Polytechnics) there is little overt commitment to pure research for its own sake. This is widely regarded, and properly so, as an activity which should be restricted to traditional universities.

The formulation of institutional policies towards research, even if largely a consequence only of limited funds, is a precedent to which the universities should pay close attention. Of course, the objection that this is less feasible if staff are to be allowed a greater autonomy in their research (as in universities), and if research is likely to be principally of a basic kind, is certain to arise. Yet, as we have discussed earlier, universities in many countries are likely to be subject to increasing pressures to re-direct their research down pre-selected channels. If research funds are freely available, then the intra- and inter-institutional strains found in the American system are a likely problem. If the funds are tightly restricted (and universities may be facing increasing competition from the non-university sector) then universities must themselves decide upon the areas of their work in which they will seek to attain "excellence". In such decisions regional considerations may feature prominently.

Institutional policies must focus upon the development (or non-development) of post-graduate work as well as of research. Governments will undoubtedly adopt different policies with regard to the encouragement of post-graduate work in a large, or small, number of academic institutions. In our view there are important economies of scale attached to the provision of advanced, taught course-work, if not of research education, and this must result in a need to avoid duplication of such courses where possible. (It is doubtful if the same argument applies to post-graduate research work.) Academic institutions must be particularly conscious of their social responsibilities in considering their policy towards post-graduate work, post-graduate research included, not only because of its requirements in resources and expertise, but because of the career-expectations which it arouses in individuals.

The assumed contribution of research to teaching has given rise to the view that research can usefully be regarded as one aspect of staff-development. Provision for research should be made in such a way, and to such an extent, that the freshness of teaching staff is maintained. This does not require the provision of expensive facilities in the institutions concerned. It could be achieved by encouraging staff to accumulate their research time into longer sabbatical periods. These periods might then be spent in a university, government, or other institution, or in an institutional Institute of Advanced Studies (such as has been created at Manchester Polytechnic). Alternatively, the teaching staff could simply carry out their day-to-day research in another department or institution as the staff of French IUT's may do.

Research of this kind is unlikely to require substantial "project" support from Research Councils. Nevertheless, these bodies might usefully consider the way in which they can best facilitate research intended to aid teaching in this way. They might, for example, be advised

to establish "small grants" committees in which the frequent bias towards big, quantitative, data-gathering research is replaced by a bias in favour of small reflective studies in which funds might be used for travel, purchase of books or documents, etc. Such committees might also make institutional grants to allow successful applicants sabbatical terms in which to do their work. (It need hardly be said that university teachers in all disciplines could very appropriately also be allowed to apply to these committees.) But, finally, we must reiterate that research is to be seen as but one aspect of staff development for teachers from institutions (and even subject-areas) with a tradition of non-innovativeness. Facilities for attendance at conferences, visits to academic centres, increased library provision, creation of consultancy centres - all are complementary to these research activities.

Finally, there is an emphasis upon applied research: research commissioned by, and useful to, local industry or service organisations. New institutions have to learn to sell themselves, and indeed to sell the practical contribution which their expertise can make to problem-solving. This may be particularly difficult, and particularly important, when new institutions have been sited in relatively under-developed areas as an aspect of regional policy. The small-scale industry and unsophisticated local organisations in such areas may lack any past contact with "science". They have to be educated into an appreciation of the help which they can receive. This process of education will have both an informal component (via social contacts, etc.) and a formal component (via the provision of short courses, seminars, etc. for local employers). Teachers in institutions of this kind must be encouraged to turn to customer organisations, not the Research Councils, in seeking to finance their research.

It is unfortunately the case that the "selling" of research to customers and its integration with teaching, may not always be compatible objectives. The first may involve a preparedness to solve any problem requiring expertise, however trivial - at least in the early stages of "customer education". The second may require a greater degree of discrimination. Whilst we do not believe that such incompatibility will often be apparent, institutions might be well-advised to establish Research Committees which, as part of their research policy, would review new research proposals in the light of both these criteria. What value will it be to the community (social and economic)? Can students usefully be associated with it, and will it contribute to their education?

V

STUDENT-INITIATED RESEARCH

INTRODUCTION

In the preceeding chapter we discussed the way in which universities (particularly in the United States) had been affected by research policies formulated elsewhere, and in the light of criteria among which their own well-being played little part. Subsequently we indicated the value of institutional research policies, formulated by and for the academic institutions themselves. Institutional research priorities must increasingly be employed in order to balance the pressures upon higher education to respond to the scientific priorities of research-funding agencies. As part of such a policy, we suggested, institutions with a specific commitment to the integration of research and teaching might assess possible research projects in the light of their apparent educational value. Such assessments would form part of the work of research committees charged with formulating institutional research policies. The last section of Chapter IV ended with a question which might be posed by such committees: "Can students usefully be associated with the research, and will it contribute to their education?" To involve students in the research is to take the integration of research and teaching a stage further than simply to assess staff research in terms of its likely educational benefits.

In this chapter we propose to take up the question of research by students, but from a somewhat different perspective. We shall be concerned not so much with the participation of students in faculty research, but with their involvement in projects initiated by the students themselves. Actual experiments of these kinds raise many questions, of which the pedagogic value of project work is but one. (On that point, we might anticipate that the educational benefits of the heuristic method would be fertilized by a much higher degree of student-motivation.) How, in what ways, and with what effect, can student-initiated research be incorporated into the academic system? Might it, for example, represent a stimulus to academic innovation no less valuable than the stimulus provided by the project-funding of research? Three sorts of experimental activity will be discussed, different in objectives, and representing different relationships between student-initiated-research and the "official" higher education system.

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NON-INSTITUTIONALIZED STUDENT RESEARCH: A BRITISH EXAMPLE

The institutional base for much of the work we shall describe has been not the formal university, but the student union: penetration of the formal curriculum and faculty activity has been slight. Yet the kind of "action research" projects which students have initiated have contributed substantially to the debate among students on the purpose of higher education. They have resulted in a change in emphasis from a concern with the process of government of universities (and the cry for student participation) to a concern with the curriculum. (1) We shall first describe a few of the projects, and subsequently point out the rationale behind the students' activities. (2)

In 1969 students in Birmingham held a Community Action Week. The majority of the 30 or so projects, in which about one third of all students participated, were concerned with renovating and decorating old peoples' homes, hostels for vagrants, community centres, etc. But one project was of a very different kind. One group of students carried out a survey of the incidence of hypothermia (a killing disease due to persistently low body temperature among old people) in an area of the city. It was believed that many more people could be dying from this disease than official statistics indicated. The students sought expert advice from university staff on medical, statistical and survey problems in order to ensure their own ability to do the study: they were well briefed. In their survey of 186 dwellings they discovered that many old people existed in situations of extreme loneliness and deprivation. Many living in new apartments with central heating did not use it - because they thought it would be too expensive or because they did not know how it worked. In the light of their findings students sought meetings with relevant organisations, including the Electricity Board, in order to press for changes - some of which they secured. The project therefore had a two-fold effect: political and educational. It motivated the students to political activity, and provided them with information on which they could base their case. At the same time it greatly increased their experience and understanding: for many it was their first encounter with the loneliness and isolation of the old. In 1970 medical students at Birmingham University carried out a survey of sanitation, housing, and the incidence of ill-health in one slum street. The medical curriculum at Birmingham has been more affected than most by this sort of community-consciousness, and the conclusion of the authors of the health-study is important: "If the doctor sees the living conditions of his patients adversely affecting their health, he should be the first to shout about it."

A somewhat different initiative has been taken in Cardiff, where students from the various higher educational institutions established Cardiff Student Community Action in 1970, with the following objectives:

> "To relate the diverse resources within the university and colleges of Cardiff to dealing with individual and community problems on a long-term basis, through education, research, information, community action projects, and the development of student studies related to the needs of the people of Cardiff."

1. This section is largely based on Alan Barr, Student Community Action, London, 1972, p. 115.

2. These activities are far from the traditional "product" definition of research. In "process" terms and in functional terms, however, their inclusion here may be justified.

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The Cardiff group have established a children's play group, and a youth club. Alongside the youth club, in conjunction with a local primary school, they have established a "teaching unit" in which a number of student teachers from the education faculty participate in an experiment in "compensatory education" with some of the young children from this deprived neighbourhood. With the aid of funds from charitable trusts, with which to employ professionals, the Cardiff SCA is establishing a neighbourhood advice and information centre in the same area. It is hoped that for students of law and social administration in particular, participation in the work of the centre will become an integral part of course-work.

These are the kinds of "action research" projects at which many student groups are aiming. They differ from traditional project work, an integral part of many academic courses, in two essential respects; their "action" orientation and their purpose. (1) The explicit objectives of students are essentially in the first place to stimulate curriculum reform (to make the experience of community problems an integral part of curricula) and, ultimately, social reform. The clear link between the two lies in the socialization of students into the professional roles which they will ultimately occupy; doctors, teachers, lawyers, engineers, and so on. Students must be forced to reassess the relationships between their future professional roles, and the community. Barr writes "a major intention of involving students in situations of deprivation has been to demonstrate the repressive and exploitive nature of many of the roles for which they are being educated". This, surely, is the most fundamental purpose of these activities. It is really any less appropriate than the attempt to re-orient post-graduate research towards industrial problems so that, as scientists, graduates will be ultimately more suitable for industry?

SEMI-INSTITUTIONALIZED STUDENT RESEARCH: AN AMERICAN EXAMPLE

There is little doubt that in the vast and diversified American higher education system many experiments such as those described above are to be found. We prefer, however, to describe a rather different approach to student-research: different in terms of objectives, scale, and backing. Whereas the initial idea for the programme did come from a group of students, it was subsequently taken up by a government agency and is currently funded by that agency. We call it "semi-institutionalized" because even with the backing it has the activity has not yet penetrated the formal curriculum to the extent its supporters ultimately seek.

The National Science Foundation introduced its Student Originated Studies (SOS) programme in 1970, as the result essentially of a proposal made by a group of Caltech students a year previously. Under the scheme, groups of undergraduate students are encouraged to seek funds to enable them to spend 10-12 uninterrupted weeks on a research project. Initially at least, such projects were to be multi-disciplinary, and focussed upon

1. It should not be concluded that this philosophy has wholly failed to penetrate the formal curriculum: some departments of medicine, and of social and community work, have certainly been affected. Perhaps more surprisingly students of electrical engineering at Imperial College, London, carry out projects, many of which are community-oriented (although not designed by students).

a problem of the physical, biological, or social environment. Projects have to be student-originated, student-planned, and student-directed; a minimal faculty commitment being discharged by a project advisor. The project director is a student. The programme proved highly competitive with only about 20% of applications receiving support. Proposals were evaluated by the NSF on the basis of scientific merit (including scientific and societal significance of the problems proposed, feasibility, the design of the study, possible usefulness of results and the scholarly potential of participants) as well as organisational strength (organisation and selection of student group, plans for direction and co-ordination of the work, etc.). In 1971 there were 102 projects with a total funding of $1.5 million; in 1972, 134 projects shared about $2 million. Some of the titles give an idea of the range of SOS projects: "Pesticide Distribution in a Typical South Eastern Region" (University of Alabama); "Air Pollution and its Relation to Lung Disorders" (California State College, Bakersfield); "Criminal Activity and Allocation of Police Manpower in Santa Barbara" (University of California at Santa Barbara); "Movement of Cadmium through Air and Water" (Purdue); "An Examination of Urban Legal Problems" (MIT); "Effects of Tetrahydrocannabinol on Behaviour and Brain Function" (University of Vermont).

What have been the objectives of the National Science Foundation in running the SOS scheme? Two objectives were clearly stated from the outset:

> "to encourage college students to express in productive ways their concern for the well-being of the United States by applying their scientific and technological expertise to the study of significant social problems;
>
> "to provide support for college or university students who can demonstrate their readiness to assume increased responsibility for their own educational development."

The scheme is in one sense elitist, being intended for students "who can demonstrate their readiness ..." (although it is clearly not elitist in the sense of any institutional bias). The first objective indicates that an extra-educational pay-off is expected. "Ideally", the NSF say, "the answers will be of potential utility to local officials who are responsible for regional planning and/or action programmes". But action research in the strict sense is ruled out: "In no event will the Foundation support political action programmes of any sort: SOS projects must be limited to the kind of objective analysis that is the proper precursor to governmental or community action".

The Foundation has now established a third objective which will be of increasing relevance in the evaluation of proposals. Evaluations will increasingly take account of the potential of the project to stimulate faculty interest in curricular change. Thought is being given to the formation of interdisciplinary faculty committees at the various institutions, to review the students' findings and to study the operation of the projects.

Earlier, we posed the question of whether or not student initiated research might be as meaningful a stimulus to academic innovation as is project-funded faculty research. The NSF clearly thinks that it is, or can be. It also seems persuaded of the educational value of such activities, at least for the most able students. But should such work be limited to the most able, or should it form a larger part of the general curriculum?

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WHOLLY INSTITUTIONALIZED STUDENT RESEARCH: A DANISH EXAMPLE

We conclude with an example in which student research has indeed very largely displaced more traditional approaches to the curriculum. The teaching methods employed in Roskilde University Centre, Denmark, represent the complete institutionalization of student-research: the institution is built around such activity. Students' efforts to secure the adoption of a similar approach in other, more traditional, institutions have stimulated a keen (even rancourous) debate on the value of the approach.

At the conceptual level those responsible for the creation and planning of Roskilde were stimulated by three beliefs. The first was the belief that short and long cycle post-secondary education should not be given in separate institutions. As we have already mentioned, the University Centres are intended to enhance mobility and reduce wastage. The second stimulus was the belief that traditional higher education is too specialized (in terms both of educational experience and of implications for subsequent employment). The third was a belief that in an increasingly egalitarian system the traditional emphasis on competitiveness, on selection and re-selection, is wrong. The value of co-operation should be strengthened. Economic considerations were also relevant, and there were hopes (in rather different quarters) that a more economical education could be devised.

Education at Roskilde begins with two years of what is called "basic education" which may be in philology, in the social sciences, or in the natural sciences. This basic education is founded upon a problem-solving approach in which groups of students (co-operatively) themselves select problems for study. (1) Formal lecturing is kept to a minimum, and the essential function of the staff is as consultants to the problem-oriented groups. Because of the ideological commitments of the students (shared by the majority of staff) an additional aspect of the teacher's role must surely be to persuade the students to reject problem-solutions based solely upon the superficial application of ideology. This would seem a very real danger: it remains to be seen if it can be avoided. There is no doubt either of the high degree of motivation of both staff and students, which would appear to be given added momentum by the project-approach. An additional argument for the basic education is that it accurately prepares students for the kind of tasks which they will be expected to perform in employment. (2)

The University Centre is very new, but it is intended that the two years' basic education will be followed by further modules, selected by each student from a wide range of options. These may be built up into either short or long cycle education (e. g., a primary school teacher would require a further one and half year study, a secondary school teacher longer).

The internal debate over faculty research indicates to what extent Roskilde is as much an experiment in university organisation as in pedagogics. The basic philosophy requires that faculty research derive substantially from student projects. In practice it is intended that a member

1. A similar approach is used in the new German University at Bremen. The German term is "Projektstudium". See "The Integration of Learning and Research in Mass Higher Education: Towards a New Concept of Science", Study III of the present publication.

2. Although, as is perceptively pointed out, the autonomy allowed is akin to the role of the basic researcher and omits "the social reality of being subject to orders and strategies developed elsewhere", ibid.

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of staff requiring substantial time or resources for research would apply to a university research committee, which might grant him his requirements from institutional resources, or might agree to support an application to a national research council. But in general the use of outside research funds is a controversial issue, since many members of the faculty object to any support from institutions to whose values they are opposed. Whilst some are prepared to sacrifice their autonomy in research to the interests of the "victims" of the system (e.g., disadvantaged groups), they are not prepared to work directly for its masters. Any research proposed from outside would be widely discussed within the university: certainly they are anxious to avoid being driven into projects which might disturb the internal balance of work within the institution, or which might alienate segments of the academic community. (Both of these are points which we have tried to support in this study.)

To the outside observer, two of the most interesting non-pedagogic aspects of the Roskilde experiment are these: the attempt to re-establish the "communal" nature of the academic institution (the integration of research and teaching; co-operation between students and staff); and the radicalism of the faculty (reflected in the debate over externally funded research). The results of an attempt at evaluating the work of the institution (being carried out on behalf of the Ministry of Education by two outsiders) will be of very great value both inside and outside Denmark.

CAN STUDENT-INITIATED RESEARCH BE GENERALIZED?

We have described three rather different approaches to student-initiated-research: different in terms of their relationships to formal education, different in objectives, and different in ideology. In spite of these substantial differences, the three experiments can be seen as having two common implications. In the first place each represents an attempt at curriculum reform. Each is an attempt at bringing students face-to-face with the problems of the real world, and with the difficulty of relating their own learning to these problems. But only in the British example has there been any conscious attempt to substitute the community's own definitions of, and priorities among, these problems for definition by the student (who in his own life is divorced from them). In the second place each may be seen as an attempt to build innovativeness into the academic system. A major benefit of project-funding of faculty research was just this: a means of overcoming in-built rigidities by partly replacing institutional ("local") priorities by professional ("cosmopolitan") ones. Research Council policy was implicitly aimed at orienting academic scientists towards these "cosmopolitan" criteria. (1) Student-initiated-research may be seen as a similar, and complementary, attempt, and in this sense at least is to be welcomed. (2) (It would be still more valuable if the community's own definitions, experiences, and priorities were more accurately reflected.)

But how far is it reasonable to go? To what extent should the academic system be based upon such an approach? Danish students press for its wholesale adoption. The American NSF considers that its SOS

1. This is a major argument used in favour of increased project funding in Denmark and the Netherlands.

2. It is to be hoped that the debate on future structures of post-secondary education will seek yet further means of building in such stimuli to academic innovation.

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programme is suitable only for the most scholastically capable, the most highly motivated. British students argue that it is in relation to the socialization of students into professional roles (teachers, doctors, social workers, etc.) that the approach is of greatest value. Of course, to some extent these differences reflect ultimate values, ultimate notions of the relations between education and society. But there is a common fundamental issue which must determine the extent of applicability of the student-research approach.

A subsidiary aspect of the Roskilde philosophy is its dedication to the needs of the student, the intention of helping him understand his place in society as an individual. To the extent that this is so, it is surely open to Robert Nisbet's criticism of much of the best liberal arts teaching in America: its middle-class orientation. Nisbet quotes from a student at the Santa Cruz campus of the University of California: "This place is so good to us there are times we suspect it's a subtly disguised insane asylym for freaks. Nobody hassles you - everybody listens. Man, that's therapy, not education." It is the middle-class student, above all, who "is accustomed to being listened to", who wants this therapy. Only the middle-class student can afford a therapy-based education in place of a vocation-based one. Evidence is provided by the fact that not all available places in Roskilde's first year were taken up. A high degree of dependence on this approach may conflict with the need to democratize higher education. Mass institutions with a commitment to the needs of the (hopefully working class) majority cannot go so far in seeking to integrate their research and their teaching, if the alienation of working class students is an inevitable result.

VI

CONCLUDING REMARKS

We have not set out directly to answer the question "What should be the place and role of research in a mass system of post-secondary education?", since it is doubtful whether any universally valid answer is possible. We have attempted the more limited task of setting out some of the hypotheses, some of the experiences, upon which the educationalist may base his policy. It has been taken as axiomatic that the higher education system has tended to over-respond to the strongly expressed science-policy view of the university-as-a-resource, of science-as-product. An alternative perspective is politically necessary, based primarily upon the educational role of the post-secondary system; upon the need to maintain (or attain) its integrity; and upon an alternative, pedagogic, view of science-as-process. An essential pre-determinant of this perspective is an analysis of the pressures which considerations of scientific policy have brought to bear upon the system: both the valuable (stimulus to innovation), and the less valuable (e. g. stimulus to inter- and intra-institutional strain). An essential axiom of this perspective is the need for institutional research policies in which the institution's own objectives, and priorities, in carrying out research are clearly articulated.

Beyond this, emphasis will differ from place to place, although it is likely that the attempt to make research serve teaching will be widespread. This may involve the use of limited research provision as an aspect of staff development; the assessment of proposed research projects in terms of potential educational benefit; or an explicit emphasis upon what we called "reflective inquiry". Research Councils may be advised to establish special "small grants committees" to fund such work in appropriate ways, avoiding the general bias against non-empirical studies. Ultimately, the integration of research and teaching may be pursued via student-initiated research, although like project funding this approach has extra-pedagogic implications. On the positive side, it too may be a valuable stimulus to innovation; on the negative side it could have a deterrent effect upon working-class students. It must be for individual academic institutions, communally, to decide upon the way in which their research must relate to their teaching, as part of their own individual policies.

Implicit in the paper has been the view that whereas mass institutions will not all have the research-resources hitherto common in elite universities, yet they must not be deprived of what benefits there may be in contact with the research process. It is therefore essential that such research, of whatever kind, that they do carry out is so organised as to yield its maximum benefit. Such a flexible perspective is to be preferred to any clear a priori demarcation between institutions which shall, and shall not, carry out research (defined in traditional "product" terms).

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Table 1. CONTRIBUTION OF THE HIGHER EDUCATION SYSTEM TO THE PERFORMANCE OF FUNDAMENTAL AND FUNDAMENTAL AND APPLIED RESEARCH

		FUNDAMENTAL RESEARCH	FUNDAMENTAL + APPLIED RESEARCH
		Expenditure in higher education system as % of total fundamental research expenditure	Expenditure in higher education system as % of total fundamental and applied research expenditure
Austria	1963	61.7	41.1
Belgium	1963	49.8	26.9
	1967	76.9	48.0
	1969	73.2 [1]	42.6 [1]
Canada	1967	53.2	29.6
	1969	62.5	33.4
France	1965	63.0	24.8
	1967	64.6	24.6
	1969	62.3*	28.5
Germany	1963	66.9	..
	1967	53.5	..
Greece	1964	27.2	11.4
	1966	43.4	22.4
	1969	29.7	15.4
Ireland	1963	89.0	20.0
	1967	86.8	27.3
	1969	85.4	27.8
Italy	1963	44.9	24.2
	1967	32.4	18.4
	1969	41.3 [1]	31.3 [1]
Japan	1965	65.4	40.0
	1967	63.5	39.8
Netherlands	1964	45.5	28.0
	1967	--	36.1
	1969	..	28.2
Norway	1963	67.2	35.5
	1967	74.7	43.2
	1969	77.0	46.6
Sweden	1964	83.7	..
	1967	87.3	..
	1969	86.9*	43.0
United Kingdom	1964-65	45.1	17.1
	1967-68	36.3	17.9
	1968	38.0	22.5
USA	1953	42.2	..
	1966	58.6	30.7
	1969	61.8 [2]	32.3 [2]

-- No corresponding data.
.. Data not available.
* Estimates.

1. Data not comparable to those for 1967.
2. Including social sciences.

Source: "Fundamental Research Statistics", Table IIIc (OECD document, 1972, mimeo.).

Table 2. R AND D EXPENDITURE AS A PERCENTAGE OF TOTAL EXPENDITURE IN THE HIGHER EDUCATION SECTOR

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1969
Belgium [1]	..	..	..	..	..	35.0	..	32.0	..	36.0	..
Canada	..	19.4	..	18.9	19.1	19.0	17.8	21.3	20.2	..	..
France [1] [2]	..	..	..	..	..	41.5	38.8	43.7	47.0	49.2	44.4
Germany	..	..	..	53.8	59.5	47.9	46.6	41.6	42.3	..	40.9
Ireland [1]	..	..	..	..	..	10.1	..	..	..	..	..
Japan [1] [3]	..	57.0	52.0	53.0	53.0	50.0	48.9	51.0	..	..	..
Netherlands	..	22.5	..	..	..	..	28.4	..	32.0	..	29.2
Portugal	..	..	..	..	..	..	13.5	..	..	..	..
Spain	..	..	..	..	..	..	7.8	..	..	..	..
Switzerland	..	..	..	..	..	..	..	..	..	30.0	..
United Kingdom	54.6	..	..	47.4	..	..	49.4	..	36.8	..	..
USA [1] [4]	..	10.1	..	11.4	..	12.0	12.1	12.5	12.9	12.6	..

1. Including social science and humanities.
2. Excluding CNRS.
3. Excluding private universities.
4. Excluding Federal Contract Research Centres.

Sources: 1958-1967: "Fundamental Research Statistics", Ibid,. Table IX.
1969: "International Survey of Resources devoted to R and D in 1969 by OECD Member countries - Statistical Tables and Notes: Higher Education Sector", (OECD document, 1972, mimeo.).

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Table 3. CHANGING SOURCES OF SUPPORT FOR ACADEMIC RESEARCH (SELECTED COUNTRIES ONLY)

CANADA: Percentage of all university research financed by the National Research Council

	1957-58	1958-59	1959-60	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68
NRC grants [1] ($ millions)	2.7	4.6	6.5	7.2	8.9	10.7	12.8	17.4	22.1	34.6	45.8
Total research expenditure ($ millions)	14.3	18.6	24.7	30.7	29.8	38.7	46.0	61.4	101.1	142.3	148.8
Percentage	18.9	24.7	26.3	23.5	29.9	27.6	27.8	28.3	21.9	24.4	30.7

1. Including scholarships and major installations.

Source: Reviews of National Science Policy Canada, OECD, Paris, 1969, Tables 44 and 52.

UNITED KINGDOM: Percentage of all university research financed by the Research Councils

	1950-51	1954-55	1955-56	1957-58	1959-60	1961-62	1962-63	1964-65	1965-66	1966-67	1971-72
Research Council Grants [1] (£ millions) ...	0.5	0.75	1.0	2.66	4.23	7.24	8.83	13.79	16.6	18.8	28.0
Total research expenditure [2] (£ millions) ...	7.5	12.0	13.2	18.9	23.9	31.5	37.2	56.0	70.3	79.5	101.0
Percentage	6.5	6.5	7.5	14.0	18.0	23.0	23.5	24.5	23.5	23.5	27.5

1. Excluding studentships.

2. Estimates.

Source: S. Blume, "Research Support in British Universities", Minerva III, 4, 1969, p. 651.

UNITED STATES: Percentage of all university research financed by Federal agencies [1]

	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Federal funds ($ millions)..	300	350	410	470	550	640	770	910	1,080	1,290	1,540 [2]	1,740 [2]
Total research expenditure ($ millions)..	520	590	670	770	890	1,020	1,190	1,380	1,610	1,890	2,220	2,510
Percentage ...	57.8	59.2	61.1	62.2	61.9	62.8	64.8	66.0	67.1	68.3	69.3	69.3

1. Includes Federal Contract Research Centres administered by universities.

2. Estimates.

Source: Reviews of National Science Policy - USA, OECD, Paris, 1968, Table 36.

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Table 4. APPROXIMATE EXTENT AND TYPE OF GOVERNMENT SUPPORT OF RESEARCH STUDENTS IN THE SCIENCES 1968-69

(Selected countries only)

	PERCENTAGES			TOTAL RESEARCH STUDENT ENROLMENT (Sciences)
	FROM EDUCATIONAL FUNDS	FROM STUDENTSHIP OR FELLOWSHIP PROGRAMMES OF RESEARCH AGENCIES	AS RESEARCH ASSISTANTS	
Canada	0	30-35 (NRC)	15-20	5,500
France	25 (Nat. Ed. Min.)	0	..	18,000 [1]
Germany	(after 1971 about 50)	0	..	3-4,000
Norway	50	10-15 (R.C.s)	10-15	500
United Kingdom	[5]	55 (R.C.s)	[5]	12,500 (full time only)
USA [2]	5 (NDEA)	15	15	100,500

[ ] : ± 5 (central and local government).

.. : Data not available.

1. Including Doctorat d'Etat (1966-67).
2. Ph.D. awarding departments only.

Source: "Postgraduate Education: Structures and Policies", OECD, Paris, 1972, p. 33.

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II

THE PLACE AND ROLE OF BASIC RESEARCH IN THE FUTURE STRUCTURES OF POST-SECONDARY EDUCATION

by

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I

INTRODUCTION

In many respects I consider the remarks that follow to be a direct supplement to Martin Trow's excellent statement in "Problems in the Transition from Elite to Mass Higher Education", prepared for this Conference, (1) as well as to some of his other work. I regard his account of the main lines of change in higher education in the past decades as, by and large, correct. Yet, by design, he says little in that paper about the dynamic interplay between academic research and the dramatic demographic and structural changes that have affected and will continue to affect higher education.

I must state at the outset that my remarks will inevitably be myopic. I cannot pretend to be a student of comparative higher education and virtually all of my research experience has dealt with American higher education. Furthermore, most if not all, of my generalizations about the research function in higher education, as well as its future prospects, devolve from the American experience. Clearly it would be erroneous to regard the United States as a "model" which has experienced certain trends in higher education and research, and to regard various other countries as simply following the historical path dictated by that "model". Each advanced industrial society will come to terms with the relation between higher education and research in its unique way, because each will experience a distinctive pattern of growth, because each has a distinctive cultural and social heritage within which this growth will occur, and because each will have a distinctive philosophy and mode of executing public policies relating to higher education and research.

Nevertheless, a review of some of the basic characteristics of the American experience, relating to the growth of research and its place in higher education in general, may be of some value. In the first place there are some major resemblances between the American experience and what promises to be the general experience of advanced industrial countries. For example, America has moved strongly toward the pattern of mass (or even "universal") higher education, which many other advanced industrial countries promise to emulate in the coming decades. (2) Furthermore, though many countries may never reach the stage of "big" science already attained by the United States - largely due to resource limitations in these smaller countries - there is nevertheless pressure for research, especially scientific research, to continue its substantial growth in the coming decades. While American policies governing the relations between

1. See Part One of Policies for Higher Education, OECD, Paris, (forthcoming).

2. See the projections for OECD Member countries - and the reasons for those projections - in Development of Higher Education 1950-1967: Analytical Report, OECD, Paris, 1971, pp. 215-217.

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research and higher education cannot be expected to be repeated, the American experience and its future prospects raise a number of general policy issues, if not particular policy solutions, that might well command the attention of those who will be responsible for guiding the pattern of future growth in other countries.

My emphasis will be on the future of research in higher education. Yet it is impossible to estimate the impact of future changes on research without at the same time knowing something about the legacy and the present status of research. To put it differently, in order to assess impact, it is also necessary to know something of the nature of the target. Accordingly, I shall begin the paper with a characterization of the institutional context of the research enterprise. Next I shall ask in what directions research in higher education has been moving in recent years, for, again, its course of direction in the future depends in part on how and where it has been travelling in the recent past. In the latter part of the paper I shall examine some of the on-going trends in higher education and in the societies that harbour higher education, and estimate the probable implications of these trends - if they continue into the future - for the fate of research in higher education. And if I may be permitted to reveal the general conclusion of my speculations, I should say that it is a pessimistic one, in that every probable future trend points in the same direction - that research in higher education faces a long season of downgrading and possibly serious deterioration unless deliberate efforts are made to preserve its status.

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II

RESEARCH AND ITS SOCIAL ORGANISATION

Academic research (which I am using as a rough synonym for basic research) involves the generation of knowledge, which is assessed - and rewarded - in the first instance by reference to the criteria of cognitive rationality. (1) By that I mean assessment in terms of the canons of logical adequacy and empirical validity of knowledge, and in terms of "creativity", or the generation of new insights. The criteria of cognitive rationality differ from discipline to discipline. The canons for excellence in mathematics, for example, tend to define as excellent that which is logically adequate, novel and "elegant"; the same criteria would apply to many of the physical sciences, but criteria of empirical adequacy, as defined by rigorous canons of experimentation and other methods, also apply. Many of the social sciences also stress theoretical and empirical criteria for excellence, although the theoretical canons and the guides for adequate research in these disciplines often differ considerably from those in the natural sciences. Historical research stresses painstaking and thorough scholarship, attention to the authenticity of historical data and imagination in reconstructing historical process in the most consistent or plausible manner. Finally, many humanistic studies - such as literary analysis - are rewarded most for extracting the most consistent and original meaning of cultural products. Yet whatever the precise character of the canons of cognitive rationality, these canons must be regarded as primary in the assessment of academic research. Furthermore, research problems (subjects for investigation, questions asked) tend to be generated internally - i.e. within the discipline's intellectual framework - and research results are assessed, in the first instance, in terms of their impact on that framework.

Cognitive rationality, however, provides only one of several sets of criteria by which knowledge is assessed. In fact, what is called "applied research" involves the assessment of knowledge in terms of its payoff in some non-cognitive context. Knowledge may be assessed in terms of its usefulness in preventing people from becoming ill, in solving technological problems, in ameliorating social problems, in fomenting or guiding social change, and so on. Indeed, one of the "applications" of knowledge involves its effectiveness as a means of educating, that is,

1. The term, "cognitive rationality", is taken from Talcott Parsons and Gerald Platt, who develop it extensively as the cultural basis for the institutionalization of higher education. See Talcott Parsons and Gerald Platt (with the collaboration of Neil J. Smelser), The American University, Harvard University Press, Cambridge, Mass., 1973.

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expanding and improving the critical abilities of students exposed to it. In applied research, furthermore, "problems" tend to be generated by a sense of uncertainty or dissatisfaction with the effectiveness of some kind of purposeful social or political activity, and a sense that this uncertainty or dissatisfaction can be overcome by generating or using knowledge as a resource.

It is possible, then, to assess the cultural products of research internally, in terms of the intellectual framework within which they are generated, or externally, in terms of the kind of use to which they may be put. In practice, however, this distinction turns out to be a continuum, since most research in the academic disciplines is generated from a mixture of preoccupations with "internal" disciplinary relevance and "external" practical utility of some sort (consider, for example, the mixed intellectual and policy considerations that spawned Keynesian economic thought). Also, the relationship between basic and applied considerations is a dynamic one, since a multiplicity of applications often become available on the basis of findings generated in a basic context - such as a new mathematical system - and an attempt to solve practical problems often leads to the creation of generalized knowledge relevant to an academic discipline. Finally, the different academic fields can be ranged roughly in terms of the degree to which "internal" or "external" concerns tend to generate problems, with disciplines like mathematics, philosophy and literary criticism occupying one extreme, with fields like law, medicine and engineering occupying the other, and with the various scientific or empirical disciplines occupying intermediate positions.

Historically, most of the basic research and much of the applied research in societies with developed systems of higher education have been concentrated in universities or research academies. Many of the institutional features of these social settings, moreover, can be understood as a social effort designed to maximize the probabilities that cognitively and empirically valid knowledge will be produced. One of the institutional characteristics of universities and research academies, for example, has been their relative insulation from the immediate social and political demands of the society in which they are harboured. (I underline the word "relative" because by any absolute standards this insulation has often been violated by interventions on religious, political and moral grounds.) This relative insulation is a sort of institutional encouragement or even guarantee that those engaged in research will enjoy the freedom to generate their research problems internally, that is, with respect to directions generated within their own intellectual frameworks, without particular regard for more or less immediate applications.

Consider also the system of institutional expectations surrounding the desired pattern of recruitment, training, motivation and rewards for those engaged in academic research. It is expected that a principal motivational component in the makeup of a research academic is a sense of dedication so strong that it will spur him to relentless, tireless, scrupulous and obsessional pursuit of cognitively valid knowledge. (1) In the recruitment for research roles, furthermore, the principle of meritocracy has been institutionalized in perhaps its most extreme form, with elaborate efforts to recruit the labours of the most intellectually talented, and with equally elaborate (though not always completely successful) efforts to exclude extraneous criteria such as kinship ties, political affiliation and religious denomination as bases for such recruitment. In addition

1. This idealized motivational complex is nowhere better described than in Max Weber's essay, "Science as a Vocation" in H.H. Gerth and C. Wright Mills, (eds.), From Max Weber - Essays in Sociology, Oxford University Press, New York, 1958, pp. 129-156.

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to attempting to secure the most dedicated and the most talented personnel, the research enterprise has institutionalized a prolonged period of apprenticeship for those who enter that enterprise, involving years of tutelage by accomplished senior research personnel, along with increasingly responsible involvement in the work of the enterprise itself. Finally, as if motivation, ability, socialization and training were not enough, the research enterprise has also institutionalized an elaborate system of rewards whereby those who succeed are catapulted to heights of prestige, esteem and honour, leaving the less successful behind to admire them and emulate their accomplishments. The research enterprise, in short, has an "overdetermined" character in the sense that most of its features can be understood as a means to recruit, train and reward the creative few.

The complex that emerges from the institutionalization of these particular expectations manifests the principle of equality in a variety of ways. In particular it is egalitarian in its principles of recruitment, insofar as institutionalized efforts are made to guarantee a career open to talent, with ascriptive characteristics other than talent minimized. Furthermore, the research enterprise - as part of the academic enterprise generally - rests heavily on the minimization of formal inequality among colleagues or peers. For example, according to the principle of colleagueship, accomplished research personnel seldom have formal authority over other accomplished research personnel, and seldom have formal power to guide their research. (1) (This principle, too, might be regarded as part of the institutional effort to maximize the insulation and freedom of those engaged in research, even from the formal interference of their peers.) At the same time, the research complex also manifests extreme inequality. The system of apprenticeship in centres of graduate training marks a long period of subordination of trainees before they can emerge as peers. Perhaps a more remarkable manifestation of inequality is the cumulative concentration of "the best" research personnel in a few centres of excellence in each society, and the corresponding concentration of the rewards of prestige and honour in these centres. Highly universalistic and egalitarian in its search for talent to recruit, the research enterprise emerges as an exceptionally elitist institution in terms of its ultimate concentration of talent and rewards.

This research complex, which I have described in ideal-typical terms, is often not institutionalized in complete isolation from the rest of higher education. Indeed, when harboured in universities it is intimately linked with a number of other functions associated with higher education. Among these other functions are:

- General education, or the attempt to develop an acquaintance with and a critical ability toward the student's cultural and social heritage;
- Providing a setting for a moratorium, or an "experimental" period between childhood and adulthood, in which the student assesses options for his adult life;
- Sorting talent and placing it in society's occupational structure;
- Placing individuals in society's stratification system; this function is related to that of occupational placement but the emphasis

1. This pattern varies considerably from discipline to discipline, with the period of research formally directed by senior research personnel extending longer in the physical sciences than in the social sciences and the humanities. In addition, traditional European faculty structures, which have been more hierarchical than those in America, have given senior faculty members more power in directing the research of the junior.

is on prestige or social ranking; it has a "mobility" aspect in so far as the university or college serves as a channel for upward movement; it also has a "barrier" aspect in so far as the skill-differentials between educated and uneducated adults are the product of so many years' education that it becomes difficult to overcome that differential outside the educational system;

- Providing service, particularly in the form of generating knowledge and expertise that is useful for the instrumental activity of other institutional complexes (e.g. medical, business, governmental, military).

It is with respect to this fusion of functions that the major difference between the university and the research academy rests; the latter is typically more specific, functionally, than the university in that it does not combine research with these other functions. As we shall see, furthermore, many aspects of the fate of research - both in the recent past and probably in the future - are conditioned by the fact that research has been institutionalized in multi-functional universities.

Most of my discussion of research and its social organisation best characterizes the institutionalization of basic research. Historically, however, much "applied" research has also been housed in universities (especially in departments and schools of agriculture, medicine, engineering and education); furthermore, this more applied research has many of the same institutional features described in connection with basic research. In general, though, more applied research than basic research tends to be housed outside the universities in other kinds of organisations, for example in government agencies, business firms, market research agencies, advertising agencies, etc. (A modicum of basic research is housed in these kinds of organisations as well.) In these non-academic settings research tends to deviate from the ideal-type university model characterized above, and to move more in the direction of bureaucratic organisation.

III

RESEARCH TRENDS IN HIGHER EDUCATION IN PAST DECADES

So much for the legacy of institutionalization of academic research that has accumulated over several centuries of development. I regard that legacy as a kind of "target" upon which future changes in higher education and in society at large will have their impact. Before turning to those projected changes, however, I should like to review a number of the recent trends which have accentuated certain features of that target and which have done much to set the stage for its future fortunes. As before, I shall characterize these trends in very general terms, acknowledging that they have proceeded at varying rates in different parts of the research enterprise and in different countries.

First, research has tended to produce knowledge that is increasingly technical and disciplined. This is most noticeable in the continuing advance of the physical sciences; but in the social sciences as well the thrust toward developing sophisticated paradigms, techniques and research methods has continued unabated, though with varying degrees of success. Even in history and the humanities, new and more technical modes of thought and research are emerging as history begins to take over the outlooks and techniques of the social sciences, and as literary and artistic criticism comes to depend on new and highly technical canons of assessment.

Second, and as a concomitant of the first, research has tended to produce knowledge that is increasingly specialized. Academic disciplines continue to spawn sub-disciplines and these spawn further sub-disciplines. In so far as each of these specialities tends to produce a burgeoning research literature of its own, research personnel are inclined, in their effort to remain proficient in their own speciality, to grow correspondingly more ignorant of other specialities. Furthermore, in so far as knowledge has come to be both more technical and more specialized, it becomes further removed from the unspecialized layman.

Third, the research enterprise has grown dramatically in several respects. Since World War II research has grown, in absolute magnitude, at rates faster than the system of higher education in which it is primarily housed. (1) Most of this growth has been financed extra-murally,

1. In the decade between 1958 and 1968, for example, federal obligations for research in America grew from a grand total of $1,079 millions to $5,406 millions, a five-fold increase. Cf. Behavioral and Social Sciences Survey Committee, The Behavioral and Social Sciences: Outlook and Needs. National Academy of Sciences, Washington, 1969. p. 226. During the period 1955-1956 the total higher education enrolment in the United States grew from 2,678,623 to 5,570,271 or slightly more than doubled. Cf. Development of Higher Education, 1950-1967, op. cit., p. 23.

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mainly by foundations and the national government. Research in different academic areas has been supported in very different magnitudes, with the natural and life sciences receiving the lion's share, the social and behavioural sciences receiving proportionately much less but nonetheless experiencing a very rapid growth, and history and the humanities increasing only modestly. (1) "Bigness" has also come to be stressed with respect to the research installation - the giant physical science laboratories, the survey research centres and so on. With these have come not only physical plant but also the proliferation of ancillary research personnel (research assistants, clerical assistants, programmers, etc.), a more bureaucratic organisation of the research enterprise and the rise of a relatively small but energetic class of "research entrepreneurs" who keep their installations supplied with research grants.

Fourth, the research enterprise has become even more centralized than before. Part of the thrust toward centralization of talent and advantage lies, as I have indicated, in the institutionalized pattern of recruitment and rewards associated with research in general. In addition, with the great burst of extra-mural spending of the past few decades, the resources flowed disproportionately into those institutions that were already centres of concentrated talent, even though considerable funds were diverted to the periphery and some new research centres were established. The growth of research, in short, meant disproportionate growth at the top of an already unequal distribution of advantage in favour of the large research universities. (2) From the standpoint of origin of resources, too, research has become more centralized, with the federal government assuming an increasingly large share; this has brought greater centralization of control over research policy as well, since decisions relating to research priorities fall more and more under the same large budgetary apparatus.

Finally, the past few decades have witnessed an increased cosmopolitanization of research. Research has always had its "universal" aspect, with communication among specialists through research journals, books, visiting appointments and the like. However the past few decades have produced not only an increase in the number of these forms of communication, but also the formation of dozens of national and international sociometric networks of specialists and sub-specialists. Mechanisms such as national meetings, international conferences and research conferences helped cement and periodically renew these networks; jet air travel and increased travel funds associated with research likewise helped them flourish. It became relatively common for research personnel at leading universities to have more loyalty toward - even to interact more with - their national and international brethren than their own university colleagues.

These trends produced both a shift in the emphasis on the different functional activities in major research institutions and intensified the stratification system within higher education. With respect to the major functions performed by the university, the gigantic growth of research

1. In 1968, for example, federal obligations for the physical and engineering sciences were $3,418 millions; for the life sciences $1,586 millions; for the psychological and social sciences $321 millions; and for "other" [illegible] millions. Cf. Behavioral and Social Sciences Survey Committee, The Behavioral and Social Sciences, op. cit., p. 220.

2. For an account of the "skewing" of research activities as well as rewards toward the high-prestige institutions, see Oliver Fulton and Martin Trow, Research Activity in American Higher Education, Centre for Research in the Educational Sciences, Edinburgh, 1972.

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facilities led universities to stress these functions, as well as the "service" functions to professional academic disciplines and to national governments, and to downgrade general education functions as well as local servicing functions. Correspondingly, the role of the faculty member became, to a greater degree, "functionally overloaded" with greater portions of his time and energy going to research, research-management, contribution to his professional association and consultation, and less time to traditional teaching activities, even though he retained formal control over them.

The increasing inequality associated with the dramatic growth of the research enterprise took a number of forms. Within the research-centred university, for example, widely available research opportunities for entrepreneurs created a centrifugal force in academic teaching units such as the department. Some faculty members were able to cut down their teaching responsibilities considerably, making a research institute or project their intellectual home, thereby leaving the less successful to carry on with the less prestigious business of departmental teaching and administration. Also within the university, research opportunities were differentially distributed, with the humanities receiving almost no increase in research funds. This pattern of support exaggerated the inequalities between various kinds of scientists on the one side and language teachers, philosophers, musicologists and historians on the other. Finally, the research bonanza tended to exaggerate the inequalities between senior and junior faculty. The majority of research opportunities came to "known" scholars with established reputations, since the granting agencies considered them the best "bets". Thus senior faculty members were likely to receive more released time for research grants and to teach less. Inequalities between research-centred universities on the one side and non-elite, teaching oriented universities and colleges on the other were also increased, by virtue of the fact that research funds - and the prestige that accompanied research activity - was growing disproportionately at the top and appeared to be consolidating if not extending the major universities' cumulative advantages. During the same decades, however, student enrolments in the entire system of higher education were expanding rapidly. Some of this expansion was absorbed by the large, research-oriented institutions, but the existing non-elite colleges and universities, as well as newly-established ones, grew more rapidly. Thus the two-and-a-half decades after World War II witnessed differential rates of growth in the system of higher education - growth at the top with respect to research, with a strengthening hold on the advantages accruing to successful research, growth at the bottom with respect to student enrolment, with increasing claims on the public resources available to higher education in general and a stronger political base to press those claims. Let me stress again that I have sketched only the general picture and that some of these trends developed further and faster in some quarters than others.

Elsewhere (1) I have argued that these multiple consequences of irregular growth generated feelings of dissatisfaction and relative deprivation in a number of academic estates - including junior faculty, graduate teaching assistants, under-graduate students, faculty and administrators in non-elite institutions; feelings that contributed to their disposition to enter into the political turmoil on American campuses in the 1960's. At this point I do not wish to press that argument, but only

1. "Growth, Structural Change and Conflict in California Public Higher Education, 1950-1970", Neil J. Smelser and Gabriel Almond (eds.), Public Higher Education in California, University of California Press, Berkeley and Los Angeles, 1973.

to point out that one of the themes of that multi-faceted period of conflict was the expression of deep hostility toward the emphasis on research in the leading universities - hostility based on the conviction that research symbolized the collaborative relationship between the universities and a corrupt political establishment and the conviction that research undermines the teaching enterprise of those institutions. That hostility constitutes part of the legacy of the academic research tradition as it moves into the 1970's.

So much for the salient aspects of the ancient and recent legacies of the academic research enterprise. It remains the most prestigious and elitist component of an extraordinarily complex system of higher education, but in the past few years it has come under criticism from many sides and has already begun to experience a period of drought after its years of plenty. What of the future? What trends are most likely to continue and develop? What will be the interaction between these future trends and the legacy of research as it is institutionalized in higher education at the present time?

IV

A CONTINUING PRESSURE TO GROW AND A CONTINUING EMPHASIS ON EGALITARIAN VALUES

From a demographic standpoint the pressure on institutions to increase their enrolments may have reached its peak. Future projections call for a slowing of the rate of growth of the 18-24 age group, and a flattening of the growth curve toward the end of the century. The growth in numbers of youth, however, is only part of the source of enrolment pressure on institutions of higher education. Advanced industrial countries are experiencing a multitude of egalitarian social movements whereas previously disadvantaged groups are pressing relentlessly for equality of various sorts. Since institutions of higher education have become, in modern times, the major vehicles for training people to enter rewarding occupations, and the major vehicles for shuttling individuals into their future niche in the stratification system, this thrust towards equality has fallen directly on these institutions. These demands take the form of a call for open and universal access to institutions of higher education, the establishment of special programmes for the many varieties of disadvantaged groups, the extension of the educational experience beyond youthful age groups into a lifelong experience and so on. Many institutions have already modified their admissions and instructional practices in the face of such demands and new institutions geared to these demands have been created. Furthermore, the demands show little sign of subsiding in the foreseeable future. To put the substance of these demands more abstractly, they mark a call for a functional shift in the activities of higher education in the direction of providing more general education, and stressing more their function of providing a channel for placement in the society's occupational and stratification systems for groups previously disadvantaged in those systems.

The thrust toward egalitarianism affects the system of higher education in yet another way. One of its manifestations is to press for the extension and equalization of various kinds of social benefits which are usually financed from the same public purse as higher education. These benefits include extension of welfare, medical care, care for the aged, improvement in the treatment of prisoners and the mentally ill, etc. As long as political pressure of this kind continues to grow - and it also shows no sign of relenting - the political competition for public funds will become stiffer, and the prospects for generous financing of higher education will become correspondingly less bright.

What are the implications of these probable trends for research? Traditionally those students from relatively disadvantaged backgrounds - e.g., lower income families - who have attended institutions of higher education have tended to adopt a relatively "instrumentalist" attitude towards their education; that is, to regard it as a training station along the way to incumbency in a more desirable occupational role and a position of higher social prestige than they had previously known. It seems

to me that the continuing pressure to extend the educational experience to groups previously disadvantaged, with respect to their access to higher education - lower class groups, women, older persons - will serve to make the composition of the student bodies of educational institutions more diverse. Furthermore, because of the nature of the contact of these groups with these institutions, their orientation toward the institutions is more likely to be an "instrumentalist" one - to acquire specific skills for specific advancement. This orientation, moreover, is likely to be associated with an indifference towards the ideals and goals of research, which will probably appear remote to the heterogeneous and more specific service aims of future students.

More generally, institutions of higher education are likely to continue to find themselves caught in the whip-saw of a clientele demanding specific educational services and a public purse rendered ungenerous because of the multiplicity of competing demands on it. This squeeze, when combined with the legacy of attitudes (from the 1960's) of scepticism or hostility towards research - from both the political right and the political left - bodes ill for the support of basic research in higher education. In that kind of squeeze research seems the least politically costly candidate for sacrifice. We may expect, then, continued pressure to reduce funds for research and continued pressure on faculties to devote "more time", in some important and measurable ways, to activities associated with the general educational and social-justice functions of higher education, and "less time" to research activities.

Another source of egalitarian pressure on the research function in the system of higher education will probably emanate from within that system. As we have seen, systems of higher education invariably become stratified, with those specializing and attaining excellence in research occupying the positions of higher status. As we have also seen, trends associated with the "golden age" of research between World War II and the late 1960's and the quantitative expansion of higher education tilted this stratification system in important ways, consolidating the prestige of leading universities and increasing the relative size and political base of the non-elite colleges and universities. We have witnessed the intensity of competition for public resources between these sectors, most notably in the United States and Great Britain. That competition shows no signs of abating. Furthermore, the pattern of competition that has developed is for the non-elite institutions to strive continuously for parity with the various kinds of privileges associated in part with the conduct of research - research funds, research libraries, sabbatical leaves, lowered teaching assignments and the right to grant advanced research degrees - and for the traditional centres of excellence to assume the posture of a conservative elite striving to maintain exclusive command of such privileges.

Given the shape of the higher-educational pyramid, with a few elite, research-centred institutions at the top and a mass of non-elite institutions at the bottom, it appears implausible that the system will "level upward", with the non-elite institutions gaining with a research emphasis. Particularly in a period of financial stringency and heavy enrolment demands, it appears an extraordinary luxury to afford those institutions servicing most of the students privileges such as reduced teaching loads and sabbatical leaves. The more likely outcome of the competitive struggle is a "levelling down", that is, equalizing the different classes of institution by dispersing research funds away from the traditional centres of excellence and by nibbling away at their traditional privileges. Certainly this would seem the more likely response of public authorities who feel political pressure to equalize but lack the economic resources to equalize upward.

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V

THE POSSIBILITY OF STAGNATING OR DECLINING ENROLMENT

The estimations in the preceding section were based on an assumption of continuing and growing student demand on institutions of higher education. In the past two years there has been some indication of a falling-off of enrolment in various countries, though it is difficult to estimate how long-term this trend may be. Let us suppose it should continue. What would be the probable implications for research if there was a substantial lessening of the demand on higher education which took the form of levelling or even declining enrolments?

In asking this question it is important to note three peculiar features of the higher education system:

a) Higher education, unlike almost all other industries, is a self-supplying industry. If there is an increase in demand for general collegiate education, the industry of higher education itself supplies the manpower to meet that demand, mainly through the training of graduate students. In this way the industry of higher education differs from other industries such as the legal industry, which, when faced with an increased demand for legal services in the population, must rely on another industry (law schools in higher educational institutions) to supply them with the manpower to meet that demand.

b) The research function in higher education is intimately linked in many ways with the graduate-training function. It is the research-centred universities that train the majority of graduate students and grant the majority of graduate degrees. And, within the universities, the magnitude of research conducted depends in part on the numbers of graduate students, who invariably are directly involved in the research as a part of their training and as paid assistants.

c) As of the late 1960's, despite the greatly increased demand for college teachers, the research-graduate training bonanza of the two preceding decades began to show signs of having produced a surplus of advanced-degree holders, both among those destined to find ultimate employment outside higher education (e.g., physicists and engineers) and among those destined for academic careers (especially natural scientists, humanists and historians). Also as of this period, the research-graduate training subsector of higher education began to resemble an investment industry at the end of an upswing of a business cycle - having produced sufficient investment goods (degree holders) to sustain a considerable level of growth of the industry it sup-

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plies (collegiate teaching) and to constitute a substantial excess capacity in the case of stagnation or decline of that industry.

Because of the peculiar historical situation of the research-graduate training complex inherited from the late 1960's, that complex promises to be downplayed both under conditions of continued growth and under conditions of non-growth. Assuming enrolment increases stemming from increased numbers and increased egalitarian demands, there will be a tendency to divert resources away from further research-and-graduate-training activities, both because of the instrumentalist pressures on institutions of higher education, and because the surplus of trained degree-holders can sustain the increased demand for collegiate teaching. Assuming stagnating or declining enrolment, the pressures to downgrade graduate training (and its concomitant, research) will be even more intense, due to the great surplus of those qualified to offer collegiate instruction. Again, like an investment industry, the research-and-graduate-training component of higher education finds itself in a position of having to endure much more extreme ups and downs than the "consumer" industry it supplies.

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VI

GROWTH, BUREAUCRATIZATION, STANDARDIZATION AND RESEARCH

In discussing the pattern of growth of higher education and research thus far, I have used as indices mainly the numbers of students enrolled and the level of financial outlay. Quantitative growth of this sort invariably creates pressures for some kind of structural change, even though the patterns of structural change that accompany quantitative growth are seldom uniform. (1) The typical structural changes in American higher education in the past 10 to 15 years have been an increase in the size of existing educational institutions and, perhaps more notable, the multiplication of numbers of institutions and their incorporation into existing jurisdictions (usually states). American higher education thus produced a pattern of multi-campus state systems, encompassing numbers of different types of institutions. Even with these changes, American higher education remained quite decentralized by comparative standards; the anticipated pattern of structural change in most other advanced industrial societies would be the proliferation of different kinds of institutions within a single, centralized system of finance and administrative direction. Nevertheless, relatively speaking, the American pattern of structural change produced a shift in the direction of centralization of the locus of allocation of resources to member institutions, more standardized means of accounting for use of resources, and - because the centre grows relatively distant from the periphery - a likely tendency for the allocation of resources based more on administrative or organisational rationality, than on standards of educational or research rationality.

In the past decade or so, the tendency towards relative centralization and standardization of some aspects of co-ordination and authority coincided with three other trends. The first is the increasing cost squeeze experienced by higher education in general, occasioned by rising costs within the educational sector and increasing demands on the public purse by other sectors. The second is the increasing pressure on policy-makers for parity of teaching load, salary, research facilities and the like, from non-elite institutions. The third is the residue of public hostility towards faculty staff in higher education, based - realistically or not - on the assumption that staff were somehow responsible for some of the student turmoil of the late 1960's by not devoting enough

1. For a classification of the various structural responses that are available to systems of higher education when confronted with the pressure to grow, as well as those particular responses that were relied upon by California higher education during its period of remarkable growth, see "Growth, Structural Change and Conflict in California Public Higher Education 1950-1970", op. cit.

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of their energies to the educational needs of students. These tendencies have converged to produce a discernible movement in a number of states; a movement which includes some effort to impose a standardized "workload formula" - or number of hours spent in class - on staff in different types of institution, to impose regulations relating to minimum size of classes, to strengthen teaching as a criterion for promotion, and even to question the legitimacy of traditions such as academic tenure.

To assess the impact of this political-administrative movement it is essential to remember the fundamental structural link between the organisation of research and the organisation of higher education in America. Because these are typically conjoined in the same institution, any policies affecting the allocation of staff energies and resources regarding teaching will directly affect the research enterprise as well. In particular, policies such as workload formulae emanating from a central state apparatus tend to be applied in an across-the-board manner, affecting all institutions within a system uniformly, including those with heavy research-graduate training complexes as well as those engaged primarily in undergraduate teaching. In so far as the former types of institutions have evolved patterns of faculty activity involving lower formal teaching loads,(1) such formulae, if enforced, would have a relatively greater impact on these institutions because of their relatively greater inroads on research. Furthermore, such formulae tend to a greater degree to be irrelevant to such institutions, since so much activity in those institutions takes place in unscheduled interaction with graduate students and colleagues on the research site rather than in classes that meet regularly, which is the undergraduate norm. Finally, in so far as time-counting systems come to be applied to research as well as teaching, administrative and other components of the faculty role (counting of research time is difficult to avoid when time-counting of any sort begins in earnest) this practice will invariably mark a reduction in the traditions of individual freedom, flexibility and control over the disposal of time that has been accorded research personnel.

One consequence of this tendency towards bureaucratization is to place faculties in an increasingly defensive position and to strengthen their disposition to organise into trade-union-like organisations. The main thrust of such associations at non-elite institutions, where the movement towards organisation has progressed further, are both defensive and offensive - defensive in the sense that they are designed to resist administrative intervention in the conditions of work, and offensive in that they are designed to gain improvements in working conditions that will bring them to a point of parity with elite institutions. In elite institutions the thrust of organisation - such as it has developed - has been primarily aimed at safeguarding the traditional academic privileges that have been granted in these institutions. But whatever the motive forces behind faculty organisations, they invariably lead in the direction of establishing procedures (such as collective bargaining) that result in written, standardized agreements that further encumber the academic structure with rules, regulations and bureaucratic "protections" of staff. Thus, with respect to bureaucratization, the formation and effective functioning of faculty organisations are very likely, first, to exaggerate the very conditions (standardization, external definition of standards of work, standardized reward systems, etc.) that they were formed, in part, to resist and, second, to endanger the principles of "the calling", collegiality, individuality and freedom that have been so closely associated with the research complex in higher education.

1. See Research Activity in American Higher Education, op.cit. pp. 40-43.

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VII

THE CONTINUING DEMAND FOR PUBLIC-POLICY "RELEVANCE" OF RESEARCH

So far almost every possible trend I have identified - increasing egalitarian pressure, flattening of growth curve of enrolment, increased complexity and bureaucratization, increased competition between elite and non-elite institutions - carries some definite threat to downgrade the emphasis on the research enterprise in higher education. Another set of trends must now be identified, trends which work in the opposite direction. I refer to the continuing accumulation of both technological and social problems that may be expected to intensify as the pace of socio-economic change in advanced industrial societies continues throughout the century.

In the past, much of the research generated in the university - particularly that generated in science and engineering departments and in schools of medicine and agriculture - has proved to be an enormously potent input in the technological advances and economic growth of the industrialized societies. (1) Sometimes this input has resulted from extensions of discoveries made in the context of basic research; sometimes it has emerged from research projects that have been commissioned to solve certain applied problems. The power of applying knowledge generated by research is most evident in the physical and life sciences. In recent years, however, agencies that are responsible for stimulating research - mainly the federal government and the large foundations in the United States - have moved to encourage social research that is more directly relevant to some area of current policy concern. In my own field of sociology in the past two decades, for example, I have seen waves of public and private research funds diverted to support research in areas such as economic and social development, medical sociology, the sociology of poverty, crime and delinquency and the sociology of education - each of which has risen at some point to a level of pressing public concern.

Certainly we must expect such preoccupation with the generation of knowledge relevant to public policy concerns to continue in the future. Continued economic growth will rest in part on continued technological innovations. So, indeed, will the solution of ecological problems - such as pollution, overcrowding and the like - that are in part by-products of the centuries of economic advance in industrial societies. The social problems associated with rapid change, such as dislocation through migration, deviance and structural unemployment, continue to feature

1. Kenneth V. Thimann, "Social Role of the University and its Science Departments", in Public Higher Education in California, op. cit.

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prominently upon the agenda of political and community leaders. Invariably an interest in the knowledge available to attack these kinds of problems will ge generated. What are the implications of this for the future of research?

The first tendency will be a pressure to encourage research to move in an applied direction. Several forces press in this direction. First, with continuing competition from other quarters for funds that might be earmarked for research, agencies dispensing such funds to research personnel will be increasingly forced to justify the use of those funds for research rather than other purposes. This pressure typically takes the form of demanding evidence that research funds have had some kind of tangible payoff in some policy-relevant sense - in reducing the crime rate, in facilitating the integration of racial and ethnic groups, in promoting effective planning, etc. These kinds of demands on granting agencies from legislators and executives "upstairs" tend to be passed on to research personnel receiving the grants as requests to demonstrate the public-policy "relevance" of their research, of guaranteeing some "evaluation" of its effectiveness and of subjecting it to increasingly detailed monitoring by granting agencies. Therefore the future promises a continuing political pressure to promote applied research, probably at the expense of basic research.

Several considerations suggest that the flow of funds toward research relevant to social and economic problems will be of a sporadic or irregular character. First, these kinds of problems do not always appear as constants on the social scene, but often tend to force themselves more or less dramatically on the public's attention, demanding immediate action, only to recede in the public consciousness after a time. Second, for any given problem area, granting agencies tend to go through cycles of enthusiasm accompanied by generous financial support followed by disillusionment because of the lack of perceived payoff from the research that has been supported. For those receiving research funds such cycles take the form of a period of forced feeding of a certain line of research, followed by a period of relative starvation. And finally, since the financing of research is becoming increasingly centralized in national governmental budgets, annual research allocations are likely to be subjected to the general fluctuations of affluence and stringency experienced by national governments. In so far as these fluctuations in research support also involve fluctuations in the support for training graduate students in specific areas - e. g. urban planning, certain types of ecological planning - the phenomenon of generating highly-skilled personnel only to find them subsequently unemployable may be exacerbated.

Finally, in so far as research personnel in institutions of higher education resist the pressure to move in more applied directions, two further trends may develop. The first is to move much research from universities into private, concession-operated research agencies or into "in-house" governmental research agencies where resistances to applied research are considerably lower than in the universities. The second is to establish new professional schools devoted to the various demands for relevance - e. g. in health sciences, public policy and community work. (1) The kinds of research that are conducted in such professional schools are typically more applied than elsewhere in the university.

1. Note the proposal for the formation of graduate schools of applied behavioural science ventured by the Behavioral and Social Sciences Survey Committee in Behavioral and Social Sciences, op. cit., Chapter 12. The move to establish more "applied" types of graduate training centres is already in evidence in many American universities.

VIII

CONCLUSION: SOME AREAS OF POLICY SENSITIVITY

As I indicated at the beginning, my conclusion is inescapably a pessimistic one as far as the future of the American scene is concerned. Every anticipated trend appears to be working in the direction of a shift away from a basic research emphasis and a very likely serious deterioration. In the decades leading up to the late 1960's, higher education in America experienced a shift in the research direction, with the emphasis on the system's cultural functions (generating knowledge) given priority at the expense of some of the other functions of education (especially undergraduate education). Now the promise is that heavy demand for some of the other functions of education - meeting the demands of continuing growth at the collegiate level, assuring social justice and providing relevant political and social services - is so salient that the basic research function will experience a serious decline unless direct intervention is made on its behalf.

What are the implications of the American experience for other advanced industrial societies, as they continue to expand their educational establishments toward mass systems and continue to move in the direction of "big" research? As I have indicated, the structure of both education and research in these countries is such that it is not realistic to expect that they will resemble the American pattern of growth. Nevertheless growth tends to generate some common problems, even though the solutions may be expected to be as diverse as the social, cultural and political conditions in the societies in which these problems develop. Rather than attempt to suggest any detailed policy solutions on the basis of the past and anticipated American experience, let me conclude by itemizing a number of policy-related issues which have proven to be sensitive in the American experience, and to which policy-makers from other societies might well be alerted.

- Serious dislocations in the research-education complex may occur if too rigid a link is maintained among the various functions of that complex. In the American experience this principle is most vividly illustrated in the very close connection between undergraduate education on the one hand and the research-and-graduate-training complex on the other; that is to say, that parts of both industries are combined in the same firms (universities). This link has contributed to the somewhat violent fluctuations in the fortunes of the research-and-graduate-training enterprise, surpluses of skilled professionals and the like. (Similar observations might well be made for other functional links; for example, if the "status-conferral" function of educational institutions is inflated regardless of the current, realistic occupational needs of a society, the prospect arises of a relatively "overtrained" population.)

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This observation is ventured with some caution, however, and should not be taken as a simple endorsement of the principle that graduate education should be organisationally segregated from undergraduate education, and that research should be isolated in separate organisations such as research academies. Some have argued persuasively that the fusion of diverse functions in the American higher educational system has played a significant role in the considerable historical accomplishments of that system.(1) and certainly some educational costs would be incurred by a too rigid separation of those who generate knowledge from those who teach it. My suggestion is rather that policy-makers be attuned to the kinds of dislocations that are possible, and that the policies of financing and otherwise supporting undergraduate education, graduate education and research be sufficiently independent and flexible to dampen the extreme swings which have characterized the American experience with research.

- Similarly, budgetary policies relating to basic research should be tailored to avoid short-term fluctuations in patterns of support, which are damaging to the continuity of effort required to generate basic research findings. This might be attained by establishing policies that insulate the research budget, to some degree, from the general swings of financial fortunes that affect national governments, and to assure a certain steadiness or "floor" of support for basic research that would not fluctuate to the same degree as support for various kinds of applied research - difficult as such policies would be to sustain politically.
- The American experience (and more particularly, the American prospects) have indicated that the institutional position of the basic-research establishment is a particularly vulnerable one, and cannot be expected to thrive, or even survive, if policy-makers respond mainly to short-term political pressures without assuring a long-term commitment to basic research. I refer in particular to short-term political pressures to divert resources to pressing social needs (which can always be demonstrated by interested groups to be more "urgent" than these of long-term research) and by competition and status-striving among institutions that tend either to downgrade the research enterprise or disperse it unduly.
- The role of the research-involved academic is particularly sensitive to overburdening and fragmentation. This is espeically true in European countries where the traditions of low academic salaries, "moonlighting" and assuming consultative, government-al roles are even more pronounced than in America. Policy-makers should be alerted to the need for mechanisms to insulate the research-involved academic and reduce his temptation to enter these other roles sufficiently, so as to prevent erosion of his research activities.

These are a few of the areas that may be subject to planning on the part of those interested in the future of the research enterprise. As such, they constitute a basis for a slightly more optimistic prognosis than I have developed throughout this paper. However I should stress that these policy issues will surely not be resolved in the natural course of events, but must be the subject of deliberate concern and deliberate action on the part of political and academic leaders.

1. Joseph Ben-David, American Higher Education: Directions Old and New, Carnegie Commission on Higher Education, McGraw-Hill Book Co., New York, 1972, Chapter 6. Parsons and Platt press the same argument in The American University, op. cit.

III

THE INTEGRATION OF LEARNING AND RESEARCH IN MASS HIGHER EDUCATION: TOWARDS A NEW CONCEPT OF SCIENCE

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I

INTRODUCTION

The discussion of reform in education has entered a new phase as the repercussions of the policy of expansion are felt in yet another institutional complex - the university. Irrespective of their differences in social organisation and historical background, the systems of higher education in practically all the industrialized nations are faced with demands for reform. From without the pressure of numbers, an expression of equal rights to education, has reached the university and necessitates policy decisions.

For the first time the institution symbolizing elite education is affected by this development. In itself, this would be no more significant than the changes which the entire educational system has undergone. However, as long as the expansion of access was limited to the traditional school system, problems of curriculum reform rarely went beyond the realm of standardized knowledge and its processes of transfer. In the university, however, it is not only the function of knowledge transference which is affected but also that of knowledge production, since the university is the principal institution in society combining both functions, and representing at the same time the formal expression of the structure of knowledge.

It is for this reason that the problems of mass higher education cannot be adequately dealt with if they are defined simply in terms of increasing numbers of students, lack of resources and inefficient institutional structures. They have to be put into the perspective of a general crisis of the university and the science which it represents. The "quest for relevance" of science, which is by no means a novel historical phenomenon, has its basis in a fundamental structural mismatch between the organisation of science - that is, primarily the university - and the organisation of society and the economy. When the relation between scientific achievement and level of qualification on the one hand and economic productivity and social well-being on the other was not clearly visible and the hierarchic social structure with the privilege of higher education for the very few was not seriously challenged, the system had different purposes, the main one being the provision of knowledge about the laws of nature. With the professionalization of research and the fragmentation of knowledge, science has grown increasingly independent of social concerns. Indeed, because there is no systematic interrelationship between science and society, science has contributed to the rising complexity of social organisation and the problems emanating from it. The university, because it reflects the fragmented structure of knowledge, fails to transmit, through its teaching function, those qualifications necessary to cope with this changing reality. The pressure on the university is a dual one, namely to reflect in both teaching and research the needs and problems of society.

Though the formulations of such demands may be rather vague, they signify the advent of a fundamental process of change in both the social conception and the organisation of science. In this paper it will be argued that the problems of mass higher education have to be considered in this wider context since the contradictions between existing structures of learning and research and perceived needs and reforms cannot otherwise be satisfactorily resolved. Some models for restructuring studies in higher education will be examined and their shortcomings pointed out. These models reveal an evolution in thinking which points to radical changes both in the structure of knowledge and in its institutional setting, the university. An attempt will then be made to identify the principles underlying these changes where they help to clarify issues and facilitate choices.

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II

MODELS OF THE STRUCTURE OF STUDIES AND THEIR INHERENT CONTRADICTIONS

As an introduction to this part of the discussion the deficiencies of the present structure of higher education and the new demands facing it will be summarized. The end of elitist higher education is held to be brought about by the following factors:

a) society's demand that higher education fulfill "a much larger and varied number of functions than those assigned to it in the past", implying a change in its value and goal structure;
b) a "change in the clientele of higher education", implying a greater variety and heterogeneity of abilities, aptitudes, motivations and expectations with respect to future professional careers and life in general;
c) the increasing importance of higher education for the economy, and, it should be added, for the management of society in general;
d) an increasing political weight (and responsibility!) given the amount of resources required. (1)

Missing in this list is a fifth point at least equally as important:

e) the growing demand for equal opportunities in acquiring life chances to determine political processes and the fate of society in general.

Given these factors, the following deficiencies of existing structures are identified:

a) first and foremost an insufficient diversity as far as possibilities of access, patterns and fields of study are concerned;
b) a lack of flexibility, i. e. of the capacity for change;
c) an incapacity "to respond to the quest of new generations for 'self-fulfillment'", or, as it should be termed, for relevance of studies and research. (2)

A number of contradictions may be seen in this list of demands on, and inefficiencies of, the present structure of higher education. Each of them presents a problem of integration of existing and/or supposed structural conditions. In terms of the institutional structure of learning they are the dichotomies of unity and diversity in general; more specifically, those of long and short cycle education, generative and receptive processes

1. "Towards New Structures of Post-Secondary Education", OECD document, Paris, 1971, p. 27.
2. "Towards New Structures of Post-Secondary Education", ibid., pp. 28-31; financial difficulties are excluded from this list as they are not structural deficiencies but rather external constraints which may add to them.

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of learning. In terms of the structure of knowledge to be produced or learned, they are the dichotomies of disciplinary and interdisciplinary content, theoretical and practical content (the latter pertaining to vocational training), general and specialized knowledge.

In the following discussion of various models for the structure of studies, it will be shown that all the models attempt to integrate contradicting institutional and curricular aspects. The conditions under which such integration may be successful are thus revealed.

THE AMERICAN CREDIT SYSTEM

The traditional American credit system, although to be distinguished from more recently developed European models of units and modules (e.g. "Baukastensystem"), shares some points in common with them. As it is well known and has been sufficiently criticized, a few remarks may serve the present purpose.

The credit system is essentially an instrument by which learning experiences can be divided and measured in terms of time and quantity. It depends on a very clear conception of the goal of learning (what is to be learned) and on the type of knowledge involved. (1) If flexibility is to be preserved, such a conception must encompass a multitude of goals and possibilities of application as well as interdependent relations between disciplines. Otherwise the flexibility of the system remains tied to the disciplinary structure of knowledge. Experience has shown that this is in fact the case and that the credit system has contributed to the fragmentation of knowledge. (2)

By definition, the credit system is only applicable in the realm of standardized knowledge and therefore can only be used in receptive learning processes. Combined with an elective system it has a potential for individualization if various courses of study could be mapped out. Its purely instrumental character accounts for the fact that it is basically indifferent to institutional structure and to the generality or specialization of contents.

THE "BAUKASTENSYSTEM"

The "Baukastensystem" ("Baukasten-Gesamthochschule") shares the idea of standardized learning modules with the American credit system but goes beyond it. Again, the system will not be described in detail. (3) Only some of the principles guiding the curriculum of the "Baukastengesamthochschule" need to be summarized. The most important in the present context are:

- "adoption of new functions such as provision of short cycle higher education and of permanent education within a multi-functional higher education institution;
- "provision of interdisciplinary curricula for every conceivable combination of fields;

1. Barbara Burn, "The American Academic Credit System", Study IV of the present publication.
2. Cf., Study IV, ibid.
3. Cf. Weizsächer, Dohmen, Richter et al., Baukasten gegen Systemzwänge, Munich, 1970.

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- "education for a world of rapid scientific development and changing occupational demands . . .
- "provision of both interdisciplinary and conventional research facilities for university teachers and students".

As far as the central element, the learning-module, is concerned, the "Baukasten"-system faces very much the same difficulties as the credit system. First of all the units are defined on the basis of the existing disciplinary structure and are limited by it. A transition from such "conventional" units to interdisciplinary project-oriented and more variable kinds is hoped for but is not theoretically or systematically planned. (1) One crucial question, then, is the planning level at which new content could be generated. It is true that the content of new units may be developed in working groups of students, but the final decision rests with departmental or institute committees made up of professors, assistants and students. Since mechanisms which would guarantee a continuous feedback to society at large are not apparent, the hope for a change in unit content becomes somewhat unrealistic.

The difficulty mentioned concerning the credit system, namely that it necessitates well defined concepts about goals for learning, the pertinent subject matter of disciplines and about the structure of knowledge, is accentuated by two other factors. One pertains to the problem of prerequisite or compulsory knowledge. Here the principle of the open curriculum is abandoned insofar as roughly six fundamental aspects (2) characterizing a discipline are chosen and assigned to different classes of units. The advantage is that modules of necessary fundamental knowledge are embedded in different contexts which may themselves reveal their relevance. It seems, however, that the choice of these basic units is made pragmatically with reference to the development of the discipline or with an eye to the unemployment situation (3) and not in relation to a problem definition or to an overall goal. This is also reflected in the fact that the desirability of interdisciplinary learning and research is stressed but that there is no mention of a mechanism for the systematic identification of problem areas or "systems". The role of "learning by discovery" in this system (which will be dealt with in another context) consequently remains on a declamatory level whereas in fact it seems to be a precondition both for the working groups generating new learning modules and for the student who is to select the modules and determine his course of study.

With respect to the freedom of choice of modules there is an awareness of the dangers of disorientation. For the hierarchically-structured disciplines, prescribed sequences of study are thought necessary. For this aspect of the model it may be interesting to wait for further experiences in order to compare them with those of the American combination of the elective and credit systems.

As a principle of organisation the "Baukastensystem" promises to integrate short and long-cycle courses, theoretical and practical content (although vocationally and theoretically oriented courses remain distinct in the model) and it allows for the association of permanent education. However, it must be taken into account that the ultimate success of these tasks is dependent on solutions in the two crucial areas which remain problematical: the relationship between receptive and generative learning processes and between disciplinary and interdisciplinary content.

1. Ibid., p. 22.
2. "Grundgesichtspunkte" as a term indicates the vagueness of what is meant. Ibid., p. 26.
3. Ibid., pp. 25-26.

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BINARY, COMBINED, FIRST-CYCLE MULTI-PURPOSE COLLEGE AND INTEGRATED COMPREHENSIVE UNIVERSITY MODELS

The binary, combined and first-cycle multi-purpose college models, as emerging institutional forms, together with the integrated comprehensive university model(1) may be considered in view of what has been said about the "Baukastengesamthochschule". All these models except the last retain the distinction between a theoretical (academic) and a practical (vocational) orientation of teaching and learning, which is unlikely to disappear even if, as for instance in the British case, research possibilities are provided for teachers. The danger here is that the evaluative distinction between "noble" and "less noble" forms of higher education will remain unchanged. This, in turn, automatically limits flexibility with respect both to access and to change of course content.

How real this danger is can be seen in the political and academic conflicts over the internal structure of the German comprehensive university. Two models are in competition, the co-operative and the integrated "Gesamthoschschule", the former probably resembling the combined model. While the co-operative model may lead to rationalization of administration and be cost-saving, the structural gaps between short and long-cycle education and between academically and vocationally oriented education are, in fact, institutionalized in the same way as before. The integration under one roof is of mere technical relevance, if any. It is, above all, an organisational solution which leaves the structures of knowledge and learning entirely untouched.

LEARNING BY DISCOVERY

Although they should be clearly distinguished one from the other, learning by discovery ("Forschendes Lernen") and project-studies ("Projektstudium") have common elements and in fact result from a common critique of the organisation of science and learning. Neither, is a clear cut model for the structure of studies in a comprehensive systemic sense (this is particularly true of the former). They are rather modes of organisation for learning and research. Because of their integrating nature, however, they seem not only applicable to practically all forms of studies but they also probably represent the most promising approaches to the problem.

It should be made clear that both concepts originated in Germany in the wake of student contestation of the existing university system and are influenced considerably by arguments of a socialist critique of the organisation of science in the capitalist societies. This critique was principally directed against the university and its training function and consequently the emerging models are primarily designed for the university. The principal elements of this critique should be restated as the conclusions seem to be valid. The critique states that the gap between the demands of a complex society and technological progress on the one hand, and an educational system providing insufficient qualifications on the other, is being dealt with by government action on the basis of concepts which imply an overall functionalization of the education sector. These

1. "Towards New Structures of Post-Secondary Education", op.cit. p. 9.

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concepts remain linked to the inherent contradictions of the capitalist organisation of society. For this reason the functionalization has two particular characteristics.

Firstly, specialization and differentiation in the division of labour and academic processes of learning prevent any possibility of reflecting upon society as a whole, thus leading to a "de-politicization" of education.

Secondly, the type of technically utilisable knowledge associated with the rise of empirical-analytical sciences represents a model of pure, value-free science leading to a "de-politicization" of research. The separation of disciplines precludes a unifying interest of understanding ("Erkenntnisinteresse") and, conversely, the liberation of science as a productive force from partial and destructive interests can only succeed if the conditions of utilization of science and trained manpower themselves become an object of the scientific process. (1) The most important conclusion derived from this analytical approach is that it reflects the relation between perception, knowledge and practical action. The organisation of research and training must provide experiences showing how theory can be applied in practice to influence individual and collective behaviour, and vice versa, how behaviour can lead to new experiences which productively change theory. (2) Both "Forschendes Lernen" and the "Projektstudium" can be said to result more or less directly from this analysis.

The organisational concept thus derived is the integrated comprehensive university. Learning by discovery is purported to be the basic didactical unit. (3) It is devised to overcome two difficulties, namely the distinction between necessary preparatory or introductory courses which are, by definition, receptive processes of learning and generative processes such as research. Thus the goals of learning are prevented from becoming an end in themselves, and preparatory courses from becoming institutionalized and possibly separated off as short-cycle courses either in other types of schools or in other departments of the comprehensive university. (4)

The decisive criterion for the structuring of the learning process is not the production of objectively new results but the exploration of, as yet, unstructured fields and the activities characteristic of this exploration, such as the discovery or rediscovery of problems and their increasingly precise definition, the formulation of hypotheses and strategies, the choice or invention of methods, the test of alternatives and the critical evaluation of results and, above all, independence in all these steps. (5) The principle of learning by discovery accepts the need to obtain information and knowledge receptively but denies the possibility of defining indispensable knowledge and abilities without having to refer to the specific problem area in which they are to be applied. (6)

One difficulty with which learning by discovery is faced is the necessary motivation to carry out the intended tasks independently (i.e. in

1. E. Becker, G. Jungblut, L. Voegelin, "Projektorientierung als Strategie der Studienreform", Studentische Politik, 2/3 1972, pp. 5-6.
2. Ibid., p. 7.
3. Bundesassistentenkonferenz (eds.), Forschendes Lernen - Wissenschaftliches Prüfen, Schriften der BAK 5, Bonn, 1970, p. 10.
4. Ibid.
5. Ibid.
6. L. Huber, "Forschendes Lernen an der Gesamthochschule", in Weizsäcker et al., op. cit., p. 91.

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groups). It is problematical to assume, as is implied, an intrinsic motivation to explore the unknown. This assumption ignores the fact that the society at large, with its emphasis on conspicuous achievement, puts a premium on the usefulness of knowledge and on success. These values are anticipated by the student preparing himself for vocational life. Only those oriented to an academic career would meet such motivational requirements probably not by chance but because the academic career promises specific advantages of social status and self-fulfillment.

The most severe difficulty of learning by discovery is that of how to achieve the relation between the choice of problems and the determination of their practical relevance. The common basis of the structuring of learning processes is the definition of fundamental types of performance ("Tätigkeitsfelder") which transcend both the traditional disciplines and professional career patterns. Not only is this term insufficiently defined and subject to diverging interpretations, probably because it is rarely substantiated by empirical information, but it is also acknowledged that one cannot safely make predictions about a constantly changing employment situation. Flexibility and the capacity for innovation therefore become the central goals of learning. It is indicative of the inherent difficulties that the definition of "projects" or "research project groups", and the determination of the relation between them and "information" or "learning units" could apparently not be achieved. (1)

This leads to the actual institutionalization of "learning by discovery" in the form of the "Projektstudium" as a structural principle of organisation. So far only the University of Bremen and to some extent the University Centre of Roskilde have been organised according to this principle. In Bremen three general criteria are given for the constitution of projects:

- The project problems must be related to the future vocational practice of students. This guarantees that isolated problems of researchers who are not involved are not selected. This criterion represents the reflexive structure of learning processes.
- The projects must deal with a socially relevant problem and be legitimated accordingly. This is related to the attempt to transcend the immediate experience of a vocation and to reveal the objective conflicts in society. The student is supposed to discover the surrounding structures of society and thereby the social frame of reference in which his future professional life is to be situated.
- The projects are supposed to transcend the limits of subject areas and methodological orientations. The problems are the references for the selection of relevant theoretical approaches, methods and accumulated scientific results. (2)

The crucial element supporting project-studies is its institutionalization in the organisational structure of the university, which in the case of Bremen did not have to be done against a background of existing department structures. Based on the idea that projects are oriented towards vocational practice and its social context and, at the same time, drawing on the methods and results of the traditional disciplines for the solution of their respective problems, the university is structured according both

1. Becker et al., op. cit., p. 17.
2. "Zum Projektstudium an der Universität Bremen", Documentation, Betrifft: Erziehung, 9, 1971, p. 24.

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to disciplinary departments and project-centres. Departments and project-centres co-operate in the project which is conceptualized and organised by the project-centre. The departments still have the task of producing knowledge in their traditional ways. Study projects apart, project-centres do their own research in analysing, for instance, "areas of (vocational) performance" as a task of curriculum research. (1) Given this concept, primacy in the organisational structure is given to the project-centres (for instance with respect to resource allocation).

The mapping out of courses of study cannot be generalized as it differs according to the different vocational areas and disciplines involved. For teacher training a project-study course is said to comprise of the following: an orientation phase during which the future vocational practice is anticipated and the professional role of a teacher in society evaluated. This phase may be organised as an exploratory project. Following this is a phase during which knowledge about a chosen subject area is acquired in projects, i. e., not within their internal structure. This phase, in turn, is followed by a terminating project with the help of which, starting from a generally relevant social problem, an attempt is made to systematize knowledge acquired in the social sciences in order to place the problematical aspects of the professional role of the teacher in a wider social context. A fourth and last phase is devoted to a continuation of study, either in disciplinary or interdisciplinary social science projects.

The model of project-studies seems to be the most advanced of its kind, at least as far as the formal principles of organisation are concerned, and superior to other models on most counts. It bridges the gap between theoretical and practical knowledge by making vocational training and the vocational role itself an object of investigation; it overcomes the disciplinary-interdisciplinary dichotomy and escapes the dangers of a rigid institutional division between receptive and generative processes of learning, i. e., of research and learning. No explicit provisions are made for the integration of short and long-cycle education but there are no inherent barriers to prevent such an integration or to imply a differential evaluation as "more" or "less noble". However, there are some fundamental problems inherent in the model and its realisation which must be discussed.

One difficulty pertains to the relation between the learning process and vocational practice. The fundamental problem which is bound to confront an experiment such as project-studies is that of meeting the demands of the employment structure. Planners acknowledge that the projects would miss their mark, if they were unable to transmit instrumental capacities which are of use under present social and economic circumstances. (2) It is characteristic of the principle of "learning by discovery", however, to play down the importance of the acquisition of requisite knowledge and to stress rather the transfer of abstract attitudinal dispositions such as "flexibility", "ability to co-operate", "ability to approach problem solutions rationally and critically", etc. Aside from the fact that the transfer of such attitudes is problematical in itself, two aspects become crucial for the contents of projects: one is the anticipation of the specific problems of future vocational practice and the other is the selection of relevant knowledge from various disciplines pertaining to the anticipated problems.

The anticipation of the problems of vocational practice makes it necessary for the university to undertake extensive and continuous empir-

1. "Zum Projektstudium an der Universität Bremen", ibid.
2. Ibid., p. 25.

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ical and theoretical analyses of the various vocational requirements. More specifically, with reference to the fundamental criteria of project-studies, vocational practice must be analysed in its wider social context. The university will also have to institutionalize efforts that guarantee the innovative flow from the university into practice. Otherwise the relation to practice would remain purely academic in nature and would merely follow and rationalize developments taking place outside. (An attempt in this direction by the university in Bremen takes the form of a contract of co-operation with the local "board of labour" ("Arbeitskammer"), a unique institution in that city. One will have to wait for concrete results.)

It has been said, not without some justification, that the model in Bremen, in the field of the natural sciences, must necessarily limit the built-in reference to practice to a very abstract consideration of the relation between science and society and the theoretical analysis of the role of the natural scientist in this context. This implies that there is a danger that the project problems will be of marginal relevance not only within the disciplines concerned, but also for the actual vocational practice to be performed later, and this may result in a deficit of qualification. In addition the student, while working in projects at the university, experiences the role of an independent researcher (learning by discovery) but not the social reality of being subject to orders and strategies developed elsewhere. It is therefore suggested that the reference to practice be established by focussing on the social reality of the respective vocational practice itself. (1) This is not a fundamental objection to the model but it does reveal additional difficulties and gives added emphasis to what has been said in the previous paragraph.

The necessary reconciliation of the two aspects mentioned above is particularly difficult for the natural sciences and it is no surprise that most of the problems arise in that field. The problems posed under the criterion of social relevance or relation to practice are not the problems of the natural sciences. It may happen, therefore, that the problems defined in the interdisciplinary process as being socially relevant draw on problems and information from the natural sciences which, with reference to their mutual structure, are only of marginal importance. This shows clearly that the institutional overlapping of disciplinary departments and project-centres has its correlate in the (epistemological) conflict between an "internal" and an "external" set of standards to determine the importance of problems, or, as one might say, two diverging structures of relevance.

This inherent conflict is at the core of the model and part of the intention emanating from the theoretical background explained above. As the project-centres are granted primacy over the disciplinary departments this constellation must lead, in the long run, to the introduction of external regulative mechanisms into the evolutionary process of the natural sciences which hitherto have demonstrated, in contrast to the social sciences, a remarkable independence in their development. This demands, on the one hand, a clarification of the immensely important question of which epistemological and evolutionary conditions are requisite for such a functionalization of science. Instead of the disciplinary departments gradually becoming obsolete, as is implied, the project-centres may become stagnant, merely applying knowledge without initiating innovative processes of theory construction. On the other hand, the overriding importance of the "external

1. W. Müller, V. Reiss, J. Klüver, R. Schulmeister, "Projektorientiertes Studium in den Naturwissenschaften", Studentische Politik, 2/3, 1972, pp. 44-57.

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structure of relevance" - its theoretical basis and constitutive principles - becomes apparent.

These problems lead to the most fundamental difficulty. The replacement of the "internal" regulative mechanisms of scientific evolution, which, in fact, have not operated satisfactorily enough to retain the unity of science, by a notion of a social relevance will only be an improvement if the latter proves capable of re-establishing this unity by an overall interest, linking scientific and social evolution in mutual interdependence. Unless the criteria of relevance guiding the choice of problems as a starting point for scientific innovation and learning can be legitimately placed within some consistent frame of reference, these choices will be accidental and lead to an even more disastrous fragmentation of knowledge with no hope for any cumulation. The anarchic pattern of growth of the first kind would simply be replaced by an anarchic growth pattern of another kind. According to accounts of experiences in Bremen the choice of "socially relevant problems" reflects the latter. (1) This has led to the realisation that the project-oriented organisation of studies can only be possible and successful if it takes place in the context of, and is guided by, a general theory of society.

1. Thus, it is reported that in planning courses of study in the natural sciences, the planning committees regularly fall back on "environmental protection" problems for chemistry and become self-critically amused about it. Muller et al, ibid., pp. 46-47.

III

TOWARDS NEW CONCEPTS OF SCIENCE AND EDUCATION
THE PROBLEM IN PERSPECTIVE

Looking back upon the discussion of new models of structures of study, one can identify a certain pattern both of similarities and evolving differences. Clearly, all the models responding to societal demands on, and structural inefficiencies of, the system of education and research have the following points in common:

- they reflect the need for more education;
- they aim at overcoming the division between academic/theoretical and vocational/practical studies with respect both to curricula content and institutional organisation;
- they attempt to bridge the gap between receptive and generative processes, i.e., between learning and research;
- they aim at transcending the division between disciplinary research and learning and interdisciplinary application and practice;
- they tend to see production, transfer and application of knowledge as interrelated functions.

The models which have been discussed do not reveal these properties in the same way but rather as a developing trend. There is reason to believe that this trend is not an accidental coincidence of national developments, especially as it starts from a fairly heterogeneous set of institutions, socio-cultural traditions and circumstances. Instead, the thesis is put forward here, that there is a common point transcending these differences and explaining this trend. This common characteristic embraces all those societies in which modern industrialization and modern science have flourished, both being linked through a technology based on the universality of scientific laws.

The conflict between societal demands on, and the structural provisions of, the educational system as well as the structure of knowledge of which it is the institutional expression, must be viewed in a more general perspective. Then it becomes apparent that it is the conflict between what could be termed an "integrated multi-purpose structure" of the application of knowledge and a "segregated mono-purpose structure" of the generation and transfer of knowledge. This means that the demands on higher education (and for that matter on the educational system as a whole), unspecified as they are, seem to reflect the realisation of a universal utility and necessity of knowledge for coping with all problems posed by social reality and, moreover, that the structure of knowledge and the ways it is being transferred, are somehow inadequate. The reasons for this disparity, I believe, are to be seen in a new stage of historical development.

Earlier forms of social organisation were based on the direct interchange of man with nature, science being an effort to discover the laws of nature. Experience (learning by doing) play an important part. This, however, is gradually being replaced by scientific knowledge. In this process society increasingly assumes the characteristics of a second nature created by man and consequently insight into and reflection upon those principles and knowledge necessary for social organisation become increasingly important, even essential. An indication of this widely acknowledged phenomenon is, of course, the change in the type of production - from primary to secondary and tertiary industries (i. e. administrative and services) - and the consecutive development of education from transmission of experience and skills to once-in-a-lifetime education in basic capacities to the present idea of permanent and recurrent education adapting to social and technological change throughout a lifetime.

On the other hand the institutional structures of research and learning and the structure of knowledge which they represent do not yet reflect this need as they are still geared primarily to the discovery of the laws of nature and not to reflection upon the principles of social organisation, and the purposive generation and application of knowledge to the problems generated by social organisation itself. The social sciences, except for Marxist schools, are hardly an exception. But theoretical efforts in this direction are appearing. One is the quest for a general social systems' theory which is accompanied by trends such as those of policy sciences. The other is the revival and rejuvenation of the Marxist tradition of a politico-economical theory of society. As pointed out above, the most advanced models of a restructuring of the system of scientific organisation lead directly to a need for, and indeed entirely depend on such a unifying theory and it is a matter of time to see which type of theory proves to be the more fruitful. In essence, then, the trend displayed in the discussion of structures of study in higher education should be seen in relation to, and as an expression of, the trend towards the normative orientation of science, and so towards an entirely different concept of science.

Unless this fundamental disparity in the structure of knowledge, its generation and transfer on the one hand and the context of application on the other is recognized, the attempts to restructure education, although appearing to attack this problem, must meet with insoluble contradictions, as is shown by the various models. Having said this, it is in no way claimed that it is possible to formulate the theory which appears to be lacking. But by putting contradictions and obviously conflicting assumptions into the more fundamental perspective, the principles by which solutions can be found may become visible. A systematic summary of the identifiable trends in the different models may clarify some such principles.

THE INSTITUTIONAL LEVEL

On the institutional level there is a marked trend towards the integration of the hitherto separated processes of research, learning and application of knowledge. Greatest emphasis is placed on the integration of learning and research. The application or utilization of knowledge is anticipated by reconciling the necessary specialization and the "process values" of research, i. e., generative rather than receptive learning ("flexibility", "capacities for innovation", "learning to learn"). This is

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synonymous with efforts to overcome the theoretical/practical, academic/vocational and general/specialized dichotomies. Essentially the problem is, as von Hentig has put it, earlier specialization and extended general education. (1)

An integration such as the one suggested in this scheme is the first step in overcoming the rigid and irreversible termination of multidimensional learning for the sake of either specialization or application of knowledge. However, the integration is limited to a certain phase in the educational process. If what has been said above is valid, the real problem seems to lie in the fact that any specialized receptive learning processes are inadequate. They are bound to lack the social reality given the reflective nature of that reality, for which they are supposed to qualify people. Therefore, institutional provisions have to be found which also allow learning processes to be reflective. This is essentially the importance of the integration of learning and research, research not being used in the traditional sense of the word. While in the traditional sense it suggests the division between discovery processes of subjectively new knowledge (learning of standardized knowledge) and discovery processes of objectively new knowledge (research), the sense in which it is used in models such as the "Projektstudium", pertains to reflective processes of discovery which can be undertaken in interaction with the social environment. Any knowledge generated in reflective processes is objectively new because it is situational and generated in reference to a changing social reality. (Concretely, of course, research processes of the traditional type have not become obsolete and will continue to exist. What is described here is a new structural development in analytical terms.) An example of the structural difference between traditional and reflective processes of learning is given in Figures 1 and 2.

Figure 2 describes the properties of models such as "project studies" and the "Baukastengesamthochschule". It implies "the transition from a system of knowledge transmission to a system of knowledge production". (2) The generation of new knowledge in the course of reflective learning processes is the result of feedback processes from application. It is obvious that this institutional structure must have its correlate in the structure of knowledge.

THE STRUCTURE OF KNOWLEDGE LEVEL

On the level of the structure of knowledge the indicated trend points toward a dissolution of disciplinary boundaries and the replacement of "internal" regulative mechanisms in the evolution of science (laws of nature) by "external" regulative mechanisms (normative purposes). The disciplines were developed in the historical phase of the identification of the laws of nature. They suggest an a priori structure of the universe of knowledge with which man cannot interfere. There is a systematic relation between this pattern of scientific development and the distinction between basic and applied research as well as the philosophy that (basic) science cannot be planned, and this has shaped the entire institutional framework in which both the production and the transmission of knowledge are embedded. In this framework the relevance of research (i.e. objectively new knowledge) is judged in terms of its contribution to the extension

1. G. H. von Hentig et al., Das Bielefelder Oberstufenkolleg, Stuttgart, 1971, p. 20.
2. Guy Berger, "Teaching-Learning Approaches in Short Cycle Higher Education", in Short Cycle Higher Education: A Search for Identity, OECD, Paris, 1973.

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Figure 1

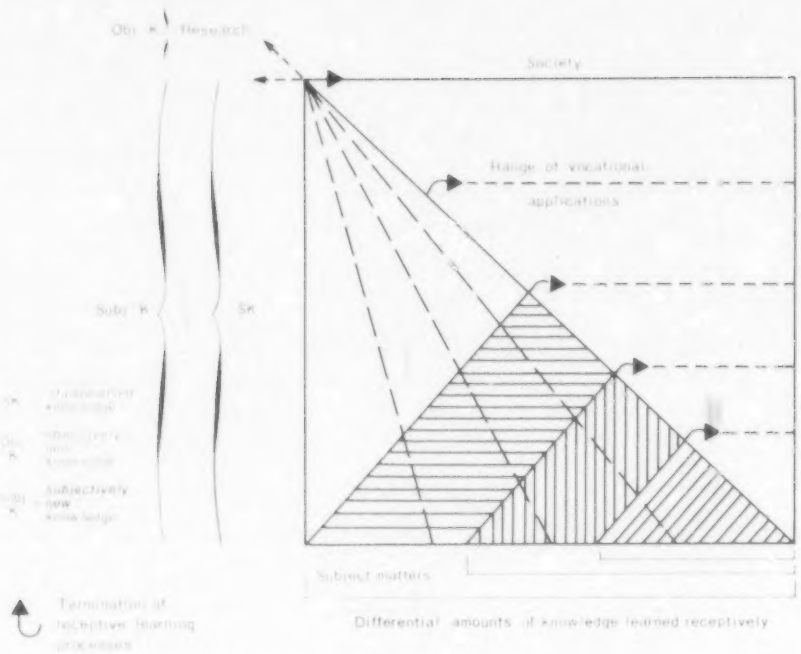
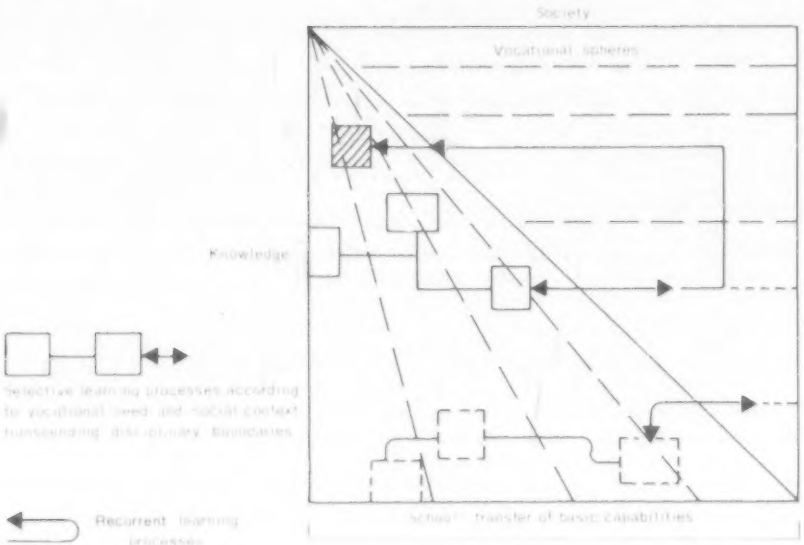


Figure 2


Society
Vocational spheres
Knowledge
Selective learning processes according to vocational need and social context transcending disciplinary boundaries
Recurrent learning processes
School: transfer of basic capabilities

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of certified knowledge, i.e., about the laws of nature, and not in terms of its applicability for practical purposes. If the autonomy of scientific development as a historical phenomenon was ever true in this sense, it has come to an end with the realization that the parallelism of an unplanned, self-regulated process of growth of science and an equally unplanned process of economic growth and exploitation of science has led to severe structural, social and ecological crises. (1)

"The crucial question", writes Erich Jantsch, "... (is) whether science and its internal system (...) or relationships is independent from human and social purpose, or whether there is a feedback link tying them together ...". This question can nowadays be answered to the effect that the link does exist. To quote him further: "Science, education and innovation", therefore, may be considered as "instances of purposeful human activity". "Organization for a purpose implies the introduction of normative and pragmatic principles which are beyond the traditional notion of empirical and empirical/conceptual science." And most important: "Scientific disciplines become organized in such a system in a particular way which depends on the normative orientation of science, education and innovation. The boundaries of disciplines, their interfaces and interrelationships no longer correspond to an a priori system of science. This is the human action model approach, as distinct from approaches based on a mechanistic model, with which man does not interfere."(2) In these sentences the most advanced position of thinking with respect to change in the concept of science is recorded. In Jantsch's model of a transdisciplinary university this trend has found what is probably a premature expression. The model of project-studies described above, although based on entirely different ideological principles, reveals remarkable similarities to it. It is interesting to note that "enlightened technocratic" thinking joins the Marxist social analysis in diagnosing the deficiencies of social organisation and the ideological nature of the self-conception of science, despite their different principles. (3)

Given that the "Projektstudium", as the constitutive principle of a whole university, is a reality and disregarding the difficulties it necessarily faces in a social, political and economic environment not yet attuned to the cognitive changes the model implies, it may also be pointed out that there are other developments which suggest that neither this, nor the far more revolutionary model proposed by Jantsch, are entirely unrealistic. The transformation of the existing structure of knowledge into a type implied by these models will certainly be a long historical process in which the knowledge of the laws of nature will not become obsolete and the quest for such knowledge will not completely subside. A change in the principles of its production is, however, likely. As this leads on to a separate discussion, it must suffice to give an example of an evolving type of science which already implies that such notions as the division between basic and applied research or between theoretical and practical knowledge will be replaced. This type of structure is still in a transitional form. It corroborates the conviction that science can be planned and, thus supports the basic premises of the proposed models for education. It includes the roots of a new principle of organisation and therefore of the structure of knowledge.

1. Science, Growth and Society, OECD, Paris, 1971.
2. Erich Jantsch, "Science and Human Purpose", Deutsche Forschungsgemeinschaft, Forschungsplanung, Wiesbaden, 1971, pp. 45-47.
3. Cf. for a critique of Jantsch's university model, S. Leibfried, "Ein Futurologisches Universitätsmodell", Futurum, 4, 1970, pp. 556-565.

Disregarding disciplinary differences and isolated historical exceptions one can differentiate between two historical phases in the relation between science and society. Traditionally scientific and social(particularly technological and economic) development have proceeded in a parallel fashion, while being contingently interrelated. This means that economic exigencies or technological inventions have often triggered off scientific endeavours which have subsequently developed into "independent" evolutions of a disciplinary nature (e. g. hydrodynamics and thermodynamics). On the other hand, both these and scientific developments otherwise stimulated, led to a stockpiling of knowledge, the utility and the application of which depended on a specific period of economic development. In other words the production of knowledge and its application were not linked by a common rationale.

This parallelism is changing increasingly to a different pattern which, although limited to areas of "big sciences", could be exemplified as follows. Economic or political pressure, combined with a certain scientific potential, may lead to the solution of a given problem through the initiation of a scientific research programme (e. g. nuclear fission and fusion, and energy shortage). Since in such cases an immediate application of scientific knowledge is not possible, scientific activity is oriented towards a specifically selected goal. In the course of the attainment of this goal a large number of "basic" problems have to be solved as well as problems of development. Although final success is by no means assured (e. g. fusion-oriented plasma physics) the evolving research activity is directed by an "external" problem and planned in that sense. It draws on other disciplines, possibly initiating new research programmes in them as well, wherever their accumulated knowledge seems to be relevant to the problem at hand (e. g. environmental research). These disciplines would not be drawn upon if the evolution were directed by "internal" criteria of relevance. Although this pattern still depends on a realization of needs and potentials and does not, in the strict sense, represent a situation of "planned" scientific development, it is obviously different from the classic distinction between "basic" and "applied" research being, as they are, consecutive and largely unrelated processes. In this sense it represents a transitory stage on the way towards the functionalization of science.

IV

CONCLUDING REMARKS ON POLICY IMPLICATIONS

The above analysis is hardly of direct help in deducing practical policy applications, more especially since it is based on the diagnosis of a historical development. Political decree will not change the conception of science nor achieve a general theory of society. Moreover, the different interpretations of the relevance of science and differences in its concrete utilization are the result of basic social conflicts, differences in power, interests and in perception of reality which cannot be eliminated and harmonized by political decree either. Purely in terms of analytical deduction it seems safe, however, to make the following remarks about some of the implications for policy making.

The influence to policy making bodies on processes of knowledge production is necessarily limited to institutional measures and resource allocation. Also, they are inclined to submit to immediate pressures on the principle of crisis prevention and management. More generally, from the above analysis it is clear that the crisis of higher education cannot be prevented if it is viewed only in terms of pressures of numbers and deficient institutional structures. A wider view implies that all attempts, leading to institutional changes which would affect the structure of knowledge production and transfer in the outlined direction, must be supported where they are most likely to be fruitful. This entails in particular:

- that a rigid separation of research and learning especially on the level of higher education be prevented. This tendency, prevalent particularly in Germany, namely that research emigrates from the university into separate research institutions, contributes to the separation of knowledge production and transfer processes;
- that attempts by universities and other higher education institutions to establish democratic political decision-making mechanisms, however insufficient and experimental they may be for the time being, be encouraged because they represent the precondition for making research and learning processes responsive to external problems. In the long run they must be enabled to achieve a planning function in the true sense of the word with respect to both institutional science and curricula policy;
- that attempts in universities and other higher education institutions to set up interdisciplinary or interdepartmental research and teaching units be defended against resistance by departments and supported by legal provisions so as to ensure their development. By putting such units in a competitive position with departments, a pre-requisite situation is created in which purposes other than those pre-determined by the disciplinary structure can be achieved;

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- that the assumption of certain service functions by universities or other institutions of higher education be actively endorsed or that such service functions be deliberately assigned to these institutions. The tradition of the American Land Grant College may serve as an example. Service functions could range from immediate community services such as adult education courses, televised educational programmes (of which there are already many examples) to services which combine research, application and information activities pertinent to both community and national problems, such as Michigan State University's Water Quality Management Project and similar enterprises. The assumption of such service functions by what may have to be a comprehensive university system would be a pragmatic first step in bringing the institution into closer contact with problems of practice and application of research as well as forcing it to provide practice-oriented teaching and information distribution. This would not only render the university more susceptible to practical problems in general, it would also strengthen central university planning of research and teaching and prevent individual contracting out by its members. In addition, while the traditional research activity would not have to be abandoned university programmes of "applied" research would be institutionalized. In this way the educational function would shift automatically from a strong emphasis on "basic" research and recruitment reflecting this situation (primarily academic), to a more realistic emphasis reflecting an employment situation which is characterized by the vast majority of academically trained people occupying positions where scientific knowledge is applied.

These are but a few cautious suggestions for policy applications derived from the above analysis and deliberately focused on the introduction of immediate institutional pre- quisites. They are entirely directed at structural change as they are considered to be at the heart of the problem of the structure of studies in mass higher education. For this reason, they may seem somewhat remote from the urgent problems of reconciling the pressure of numbers with present structures. It is believed, however, that these and other seemingly long term measures are essential for the solution of these very problems.

The difficulties inherent in the tendencies underlying discussion about the structure of studies are no fewer than those with which the present system is plagued. Although an option has been chosen and its superiority over other models justified, there is no doubt that the possibilities of political realization are few. But it seems legitimate to believe that innovation is hampered not only by political resistance but equally by perceptions of reality. This paper is conceived of as an attemp to show that the very structure of knowledge through which our perception is determined prevents us above all from imagining that the constitutive principles of knowledge and the institutions through which knowledge is generated and transmitted may undergo revolutionary changes. Discussion about the structure of studies and the role of research is, I believe, an expression of just such change and not merely a problem of reconciling mass higher education with maladjusted institutions of learning and lack of resources.

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IV

THE AMERICAN ACADEMIC CREDIT SYSTEM

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I

INTRODUCTION

Abraham Flexner, analysing higher education in the United States some forty years ago, characterized the American academic credit scheme as "an abominable system, destructive of disinterested and protracted intellectual effort". (1)

Flexner was not the first to attack the credit system and in recent years especially its critics have multiplied. Furthermore, the definition of a credit - theoretically a precise unit for measuring higher education - has lost much of its precision, and at a growing number of colleges and universities in the United States the credit system has been modified almost beyond recognition and in some instances abandoned altogether. Whether some other system might be devised which would enable students to acquire a higher education, through the accumulation of educational experiences that eventually add up to a degree, and thus would provide both the diversity in curricular programmes and possibilities for inter-institutional transfer of students which the credit system offers, remains to be seen.

Despite recent trends to modify the credit system, in general the following definition of the credit hour, the unit on which the system is based, still remains:

> "The unit by which an institution may measure its course work. The number of credit hours assigned to a course is usually defined by the number of hours per week in class and the number of weeks in the session. One credit hour is usually assigned to a class that meets fifty minutes a week over a period of a semester, quarter or term; in laboratory, field work, drawing, music, practical arts, physical education or similar type of instruction, one credit hour is assigned for a session that meets one or three hours a week for a semester, quarter or term. Quarter credit hours and semester credit hours are the most common systems of measuring course work. Institutions on the trimester plan generally use the semester credit hour system. Courses offered in a calendar other than semester or quarter, including summer sessions, may be measured in term credit hours or stated in semester credit hours or quarter hours." (2)

1. Abraham Flexner, Universities, American, English, German, Oxford University Press, 1968, p. 64.

2. National Center for Educational Statistics (Office of Education). Definitions of Student Personnel Terms in Higher Education, OE-50083, U.S. Government Printing Office, Washington, D.C., 1968, pp. 14-15.

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How the credit system was launched in the United States may throw some light on the aims which, at least initially, it was devised to fulfill. (1)

1. For background on the development of the credit system in higher education the writer recommends Dietrich Gerhard's "The Emergence of the Credit System in American Education considered as a Problem of Social and Intellectual History", American Association of University Professors Bulletin, Vol. 41 (Winter 1955), pp. 647-668.

II

ORIGIN OF THE CREDIT SYSTEM

The American system of academic credit had somewhat separate though related origins, in the secondary schools and in higher education. Up to the 1870's higher education institutions tended to follow the relatively fixed curricular patterns common to most European higher education systems. As Charles W. Eliot, President of Harvard University 1869-1909, phrased it, students in the same subject advanced together, "like soldiers on parade". Within a given course of study the student had almost no choice. There was little need to measure more than the end product of the system, the student on the threshold of obtaining his degree.

In the 1870's this system underwent rapid change. In 1872 President Eliot initiated the elective system at Harvard University, replacing the system of fixed curricula with an increasingly wide choice of courses for students. Starting with electives for senior students only, by 1884 it offered almost complete freedom of choice to students in all class years, and shifted in the 1890's to measuring progress towards a degree on the basis of the accumulation of individual courses rather than the completion of a total course of study. Other colleges and universities quickly followed Harvard's example if they had not already preceded it. Thus, by 1877 the University of Michigan was requiring 24-26 courses for a degree, a course being defined as five exercises a week during a semester.

The credit system emerged as a corollary to electives. Towards the end of the 19th century and in the early 1900's it became increasingly common practice for colleges and universities to list in their catalogues the number of credits offered by each course, the number being determined by the hours of classroom or laboratory work devoted to the course per week. Degree requirements were stated in terms of numbers of required credits. Finally, in the early 1900's the credit system was extended beyond undergraduate study to include postgraduate programmes as well.

Some of the forces behind the introduction of the elective and credit systems in the United States close to a century ago may have pertinence in countries which today may be contemplating a comparable structuring of their higher education systems. Among these forces was not a demand on the part of students and/or institutions to facilitate the transfer of students between institutions. This only emerged as a force much later, entrenching as well as complicating the operation of the credit system.

A critical factor was the pressure to replace the uniform classical curricula with something more flexible and suited to contemporary needs. American higher education should no longer have as its major emphasis the production of cultivated, pious gentlemen. The concepts of student-

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centred learning and of the self-realization of the student achieved through study fitting his individual interests, which were advocated by the philosopher John Dewey and his followers, began to infiltrate thinking on higher as well as elementary and secondary education. The public demanded more selection and variety in courses at colleges and universities and, especially, more courses of a practical nature. The institutions themselves, struggling to recruit students, felt impelled to offer students more curricular choices in order to expand or even maintain their enrolments, and to shift from their historic religious orientation towards secularism.

With industrialization the colleges and universities were called upon to provide new kinds of scientific and professional education. This new mandate was made explicit in the case of the Land-Grant Colleges (its impact extended beyond them) established under the Morrill Land-Grant Act of 1862. This Act had as its aim "to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life". Thus, towards the end of the 19th century higher education was beginning to shift its emphasis from general to professional - and even utilitarian - education, to move away from its traditional elitism and to serve new kinds of students and new social needs.

At the same time as the new elective and credit systems enabled American higher education to reflect better the new economic and social forces in the United States and to respond to the needs of modernization, they were also seen as a vehicle for introducing into American higher education a fundamental feature of the science-oriented German higher education system, "Lernfreiheit". The German system was regarded by President Eliot and many other American educational leaders of a century ago as a model of excellence, and the elective system was considered a means of importing Lernfreiheit to the American scene, even if totally out of context. The elective system was also regarded as a means of permitting greater specialization in curriculum, another feature of the German system held in high regard. And in the face of the increasing curricular variety at colleges and universities, the credit system offered a way of measuring the common progress of students towards a degree.

Paralleling and re-enforcing the introduction of the credit system in higher education was its introduction in secondary schools, where it was instituted for somewhat different reasons than at the higher education level. In the last few decades of the 1800's secondary schools multiplied in numbers and total enrolments, new kinds of courses were introduced in their curricula, and the problem of setting somewhat consistent college and university admissions standards became acute. Often the distinction between secondary and post-secondary education was blurred as higher education institutions lowered or waived their admissions standards in the interest of recruiting students, and even operated their own secondary schools. It became increasingly recognized that the growing diversity in curricula and quality among secondary establishments called for nationally accepted norms for admission to higher education.

Stepping into the breach in 1909 (after groundwork had been laid through the activities of a variety of bodies), the Carnegie Foundation for the Advancement of Teaching, with Charles W. Eliot as head of its board of trustees, prescribed that for college and university teachers to be eligible for new retirement allowances from the Foundation, their institutions had to fit the definition of higher education institutions set forth by the Foundation. A critical element in this definition was that admission requirements include the satisfactory completion by pupils of 14 "standard units", a unit being defined as "study pursued for one year

with recitations five times weekly". To obtain retirement allowances for their teachers, colleges and universities quickly fell into line, imposing what came to be known as the "Carnegie unit" system on secondary education. Some had in fact followed such a system well before the Carnegie Foundation's intervention.

The credit system at the secondary school level has persisted over the years with relatively little change. It is at the higher education level that the credit system has come under the most fire and that efforts have been made to reform if not eliminate it. A review of its evolution since its inception illuminates some of its more controversial features.

III

EVOLUTION OF THE CREDIT SYSTEM IN THE UNITED STATES

The history of the credit system in the United States since it was first launched is chiefly a record of efforts to counteract its deficiencies, especially the fragmentation of knowledge and the underlying assumption that learning can be equated with time spent in the classroom. Most recently the focus has been to make "creditable" towards a degree various kinds of learning experiences which are measured by other criteria than the time invested in them.

Because the credit system tends to be identified with the elective system but in fact could be used with a prescribed curriculum, the following sub-section discusses the characteristics and commonalities of the two systems. The next two sub-sections review efforts to counteract the deficiencies of the credit system in terms of fragmentation of knowledge and of equating learning with classroom time. As will be seen, these deficiencies should not be attributed solely to the credit system, but the credit system as it has been combined with electives in American higher education.

THE CREDIT AND ELECTIVE SYSTEMS

Underlying the debate on the American credit system has been the question of what constitutes an undergraduate education. (The role of the credit system in graduate education has been less controversial because at this level its alliance with electives has been limited; the freedom of the student to select his courses obviously has far less applicability when the goal is to train specialists.) At the undergraduate level the credit system raises the questions of whether a degree should be defined in terms of the kind of knowledge obtained or rather of the quantity of knowledge acquired, or both, and how the knowledge gained is to be evaluated for these two different approaches.

In the American experience the elective and credit systems have sometimes been confused and should be distinguished from each other. What kind of knowledge or subject content is required for a degree is a question pertaining to the elective system; how much knowledge is required and how it is measured quantitatively relates to the credit system. In so far as the credit system is often viewed as a means of achieving more student-centred higher education, implying that it gives more choice

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to students of the content of their college or university programme, the public has tended to see the elective and the credit systems as largely identical. This shared identity has been misleading.

The relative freedom of the student to choose his individual courses or subjects is the crux of the elective system, but is not essential to a credit system. Essential to the credit system is an arrangement whereby separate learning experiences can be measured quantitatively so that by accumulating a series of these experiences the student eventually earns a degree. Common to both the elective and credit systems is the division of higher education into a number of pieces so that the student in the elective system can select among different learning experiences as he progresses towards a degree, and the student in the credit system can add up a number of learning experiences, whether of his choosing or prescribed by some authority, to acquire the degree. Thus, both systems share the assumption that fields of knowledge can be broken down into small components and the pieces reassembled in a variety of ways: by the student in the elective system or according to prescriptions of the authorities concerned in a credit system (unless it is also elective). How small the components should be and how they can most effectively be assembled into larger learning patterns are questions, in the American experience, to which the answers become increasingly, not less, elusive.

Another assumption shared by both the elective and credit systems relates to the aims of higher education. Both implicitly admit that the notion of precisely defining the curriculum for a degree recipient in any given field is obsolete and futile. There is no longer any wisdom from on high - or from academe - which authoritatively prescribes what students ought to learn. Lacking this, and with no clear guidelines on the kinds of educational experiences which the future employment situation will require of college and university graduates, both the elective and credit systems put a premium on flexibility. The elective system therefore enables students to determine the content of their higher education experience while the credit system makes possible more varied combinations of learning experiences, whether the combinations are prescribed or elective.

The disappearance of a precise definition of the university graduate has been accompanied by a subtle erosion of the conventional wisdom that only the professors are qualified to determine the content of a degree programme, to teach or at least prescribe it, and to evaluate it. Thus, the ultimate conclusion of student-centred higher education, whether through the credit or elective systems or both, may be the eventual dethronement of the professoriate, or, more likely, a gradual diminution of the academics' monopoly over degree certification.

THE FRAGMENTATION OF KNOWLEDGE

One of the chief weaknesses attributed to the credit system - that it fragments knowledge - can only be attributed to it in part. More to blame perhaps is the fact that the basic course, as it has evolved in the United States, typically lasts for one semester only, and that the normal course load for a student in a semester is four to five courses. Consequently students take as much as forty different courses in the process

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of earning the first degree. (1) Clearly, if the typical course lasted a full academic year instead of a semester, and if the normal semester course load were three rather than as many as five courses, knowledge would be chopped in larger blocks and a student would take twelve, not forty courses to complete his degree. The fragmentation of knowledge alleged to result from the credit system is thus, in large measure, the product of the size of the building blocks into which the degree has been divided.

Exacerbating the credit system's effect of fragmenting knowledge is the elective system. When students are totally free to select their courses according to their individual interests, a state which really existed hardly at all or only very briefly in the United States, whatever underlying unity or pattern is to be found in the student's total educational experience depends upon the individual student's rationale in selecting his total programme. It may afford him the opportunity to achieve an in-depth knowledge of a particular field, or it may equally produce an individual with smatterings of knowledge about a multitude of disparate subjects. Joseph Ben-David of Hebrew University pointed out this dilemma in summarizing the strengths and weaknesses of the elective system in its early stages in American higher education:

> "By granting academic freedom to both teachers and students, it made it possible for teachers who had easily identifiable specialized knowledge and skills, and for students interested in acquiring those things, to find each other and to develop the relevant fields of study rapidly and without serious problems concerning the ends and the means of education. "(2)

> "There was a large group of students, those interested mainly in having a good time in the company of their peers and acquiring social contacts and habits useful for their future careers, who had no congenial counterparts among the teachers, and whose needs were not (and perhaps could not be) catered to even in the most liberally elective curriculum. "(3)

In short the credit system may be a boon to the student seeking specialization, a boondoggle for the student lacking direction and focus in his pursuit of higher education - assuming it is linked with course electives.

Related to the problem of fragmentation is the insidious effect the American credit system has had in causing students to look at the attainment of a degree as the accumulation of academic credits rather than the mastery of knowledge. Earning a degree becomes an arithmetic exercise rather than a means of learning. Writing in 1917, Abbot L. Lowell, successor to Charles Eliot as President of Harvard University, commented on this:

1. This fragmentation was graphically described in a pamphlet produced by a student activist at the University of California, Berkeley, as follows: "As an undergraduate you receive a four-year-long series of sharp staccatos: eight semesters, forty courses, one hundred twenty or more units, fifteen hundred to two thousand impersonal lectures and over three hundred oversized "discussion" meetings ... Over a period of four years you receive close to fifty bibliographies, ranging in length from one to eight pages, you are examined on more than one hundred occasions, and you are expected to write forty to seventy-five papers". Joseph F. Kauffman et al., The Student in Higher Education, The Hazen Foundation, New Haven, 1968, p. 50.

2. Joseph Ben-David, American Higher Education: Directions Old and New, Carnegie Commission on Higher Education, McGraw-Hill Book Co., New York, 1972, p. 60.

3. Ibid., p. 61.

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"One of the most serious evils of American education in school and college is counting by courses - the habit of regarding the school or college as an educational savings bank where credits are deposited to make up the balance required for graduation, or for admission to more advanced study. "(1)

OVERCOMING THE FRAGMENTATION: CONCENTRATION AND DISTRIBUTION REQUIREMENTS

To bring some unity and integration into the learning process, President Lowell replaced Eliot's free-elective curriculum with a system requiring "concentration" and "distribution". Instead of having almost total freedom in selecting their courses, the concentration and distribution system requires students to focus part of their work in one field, their so-called "major", and to so choose other courses that they achieve some understanding of (exposure to) the natural sciences, the social sciences and the humanities. Further limiting the elective system is the concept of course prerequisites and sequences; differences in the content and degree of complexity of courses in a given discipline require that less advanced courses by taken before those which are more advanced or specialized. These kinds of requirements continue to characterize the curricula of most American higher education institutions today, although they are eroding in the face of student - and sometimes staff - pressure against curricular prescriptions in general.

The concentration and distribution system, while addressed in part to the problem of the fragmentation of knowledge, was actually also an attempt to reconcile curricular choice with the American notion of the liberally educated person. Since American higher education began to break away from the fixed curriculum tradition through the introduction of electives, it has sought a balance between breadth and depth in education, between general education which seeks "to introduce the undergraduate to the rudiments of the whole of man's intellectual heritage"(2) and specialized education in the best 19th century German tradition of Wissenschaft.

In the absence of a precise definition of general education, the insistence that students be exposed to the three main branches of knowledge, through distribution requirements coupled with their relative freedom to choose among courses satisfying these requirements, has, in the view of critics of the system, tended to confirm rather than to counteract the fragmentation of knowledge. A potpourri of social science, natural science and humanities courses, sometimes selected by the student with an eye to what will be least demanding among the array available, frequently fails either to produce "the whole man" or to integrate a scatteration.

Re-enforcing the notion of concentration and distribution requirements are the traditional criteria for membership in Phi Beta Kappa, the most prestigious academic honour society in the United States which dates back to 1776. Dedicated to "the ideal of excellence in scholarship in the liberal arts and sciences", eligibility for membership requires

1. Abbot L. Lowell, At War with Academic Traditions in America, Greenwood, 1934, p. 276.
2. Eric Ashby, Any Person, Any Study, An Essay on Higher Education in the United States, Carnegie Commission on Higher Education, McGraw-Hill Book Co., New York, 1971, p. 7.

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that in addition to having a superior academic record a student must take at least 90 of his 120 total semester hours in "liberal work" and no more than 42 in his major. Given that, not only is the credit system in the United States undergoing significant change but also that the practice of assigning grades to students' work is being reassessed and even abandoned in some institutions, it should come as no surprise that Phi Beta Kappa is actively rethinking its basic assumptions concerning a liberal education and excellence and its role in helping to define academic values in American higher education.

HONOURS PROGRAMMES

As the distribution and concentration programme provided only a partial cure to the credit disease, other remedies have been sought over the years. One of the earliest and perhaps most significant efforts to counteract the fragmentation of knowledge by the credit system has been the "honours" programme. Frank Aydelotte, a former distinguished President of Swarthmore College, instituted an honours programme there in the early 1920's. His critique of the credit system indicates what the honours programme sought to avoid:

> "The academic credit system as ordinarily administered is for these better and more ambitious students a kind of lock step; it holds them back, wastes their time, and blunts their interest by subjecting them to a slow-moving routine which they do not need. It causes, furthermore, the atrophy of the qualities of independence and initiative in more gifted individuals by furnishing too little opportunity for their exercise."(1)

The honours programme at Swarthmore - and the model established there has been common to honours programmes elsewhere - gave to the more able and motivated students the option of participating in special honours seminars and tutorials instead of following regular courses during their last two years at college. Course and hour requirements and compulsory class attendance were waived for honours students. Student achievement was measured through examinations, written and oral, conducted by external examiners at the end of the senior year. This was a major departure from semester courses and course terminal examinations. As Aydelotte put it, honours programmes in the United States have been more akin to those of English universities which do not tell the honours man "what he must do in order to get an education; they tell him what he must know". (2) As at the British universities, generous faculty resources were needed to staff honours programmes.

Current developments in honours programmes reflect a shift in goals. While a chief aim continues to be to offer more flexibility to students in their course work and to meet the needs of students who wish to commit themselves more intensely and fully to the learning experience, the concept that honours programmes should be only for students of proven

1. Frank Aydelotte, Breaking the Academic Lock Step: The Development of Honors Work in American Colleges and Universities, Harper and Brothers Publishers, New York and London, 1944, p. 14.
2. Ibid., p. 15.

exceptional ability is breaking down. It is being attacked as elitist. Pressures are mounting to provide the kinds of extra teaching resources common to honours programmes to disadvantaged rather than superior students. Also, the "monopoly" of honours programmes over experimentation in individualized learning is fast disappearing with the burgeoning of many other new experimental programmes. A trend now is to define an honours programme by the level of work which it offers its students rather than on the basis of some pre-judgement of their academic ability; to shift from selection by the professors to self-selection by the students. All students, regardless of ability, should, it is argued, be entitled to alternatives to the fragmentation of knowledge allegedly produced by the credit system.

CURRENT EFFORTS TOWARDS MORE INTEGRATED AND SELF-DIRECTED STUDY

Other recent efforts comparable to honours programmes to "break the academic lock step" include programmes of independent study, field study, off- and on-campus internships, travel and study abroad, participation in community projects, and a range of other kinds of learning experiences which depart radically from the notion of acquiring a higher education bit by bit through the accumulation of small chunks of knowledge in semester courses. A primary aim of these relatively recent innovations in American higher education is to give the student more independence and responsibility in determining the content of his educational experience and achieving coherence within it. Another aim, also relevant to alleged deficiencies in the credit system, is to redefine the experience which is "creditable" towards a higher degree away from the tradition that learning can only take place in a classroom and hence is measured by the number of hours spent in class.

To illustrate these more recent efforts, at some American colleges and universities a student may, with the agreement of the faculty member concerned, enrol in a course and complete the work for it without ever attending class. Thus, a student in renaissance art may with his professor's approval spend the semester in Europe rather than on-campus, and demonstrate his mastery of the subject matter through writing journals, reports and such other papers as the professor may assign. A student in history may devote a semester to living in, and studying the archives and other records of, a small town and writing up its history, and gain a full semester's worth of academic credit for this experience. Facilitating this trend is the fact that an increasing number of American colleges and universities are offering semester courses in "independent study" or "special problems", the syllabuses of which are not defined. Students gain credit in such courses on the basis of the understanding they establish with their professors on what they will accomplish in the course and how it will be evaluated for credit.

Internship, apprentice and related experiences enable students to gain credit, again with the approval of a faculty member, for such activities as working for a welfare agency, a member of a state or national legislative body, or a unit of the university itself. For example, every semester one hundred or so students at the Yale University Law School earn one or two credits towards their law degree for researching and drafting legislation for state legislators in Connecticut and elsewhere. Once again, the underlying hypothesis is that education should not be

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equated to the time spent in a classroom, that the credit system of parcelling out education frustrates serious learning, and that the experiences which add up to a degree in higher education cannot be defined only in terms of time and place. Students should not merely add up classroom experiences defined by the professors which may or may not cohere, but should have the opportunity for self-directed, intensive and integrated study.

NEW DEPARTURES FROM THE CREDIT SYSTEM IN ACADEMIC ASSESSMENT

A few American colleges have taken the ultimate step in overcoming the fragmentation of knowledge through the credit system which is to eliminate credits altogether. Hampshire College in western Massachusetts, which admitted its first students in 1970, is one example. Instead of determining a student's readiness for advanced work or for the Bachelor's degree by how many courses and credits he has accumulated, Hampshire makes this decision on the basis of examinations administered when the student and his tutors agree on the student's readiness to be examined on his learning experience thus far. Because every student's academic programme, is different and their rates of progress vary, each student is examined individually and even joins with staff in deciding how he should be examined on what he has learned. Hampshire's educational offerings include a whole gamut of independent study, field experience, student-taught courses, self-instruction using the new technology, tutorials and seminars.

Manhattanville College outside New York City is another college seeking to break the academic lock step by downplaying courses and credits. It has instituted a "portfolio" system of academic assessment whereby a student's work is recorded, not just in the conventional transcript which counts up the courses and credits he completed, but through an array of evidence describing and evaluating what he has done. The faculty proposal for this new system stated that an acceptable portfolio should include:

> "... grades or written evaluations for all courses taken; examples of the student's best work, at least one of which represents the results of independent study; certification of completion of the major by a department, or by faculty directing independent concentration; evidence of the attempt on the part of the student to relate his own field of special interest to a wider intellectual and human context; and annual written evaluations prepared by the student and his adviser and signed by both. "(1)

These new experiments which depart radically from the traditional credit system may be pioneering new directions in American higher education. However, it remains to be seen whether they really represent practical alternatives to the credit system. As regards both academic programme and student evaluation, the new, more individualized, student-oriented, and student-directed model would appear to require a much larger investment of faculty time than the traditional regimented

1. Robert Nathan, "Manhattanville: From Tradition to Innovation", Change, Vol. 4, No. 9.

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course credit system (although a basic assumption of Hampshire College is that it can implement its new approaches to teaching and evaluation with the 1:16 staff/student ratio typical to large public universities). In a mass higher education system which is rapidly moving towards universal higher education, it is questionable whether many institutions can muster the faculty and other resources required to offer what might be regarded as an honours-type programme to all students rather than to only a few.

Still another problem which this new model may pose involves the evaluation of students' undergraduate records for jobs and for admission to postgraduate study. Will employers or the admissions officers in law schools, medical schools and graduate schools, beseiged by applications as they are, be able to study and digest a student's record when it is a voluminous portfolio instead of a single transcript of courses and credits (admittedly accompanied by several personal letters of reference)? An alternative is to evaluate undergraduate performance using the results of graduate admissions examinations. Such examinations already exist; for example, the Graduate Record Examinations which are administered on a national level by the Educational Testing Service. From being only one element in the student's graduate application, scores on such tests may acquire more weight in admissions decisions, although there is no such trend in this direction as yet. Should this happen, there would be a certain irony if efforts to overcome the fragmentation of knowledge caused by the credit system through shifting to more individualized undergraduate education, were to eventuate in a system of external examinations, somewhat akin to European models, as a means to measure undergraduate performance. At present, however, such development appears unlikely even though other expeditious means of evaluating individualized undergraduate education to replace the credit system have yet to be found.

A WANING ASSUMPTION: THE EQUIVALENCE BETWEEN LEARNING AND CLASSROOM TIME

Paralleling efforts to counteract the fragmentation of knowledge allegedly caused by the credit system have been efforts to reinterpret what the credit hour stands for and to revise the operation of the credit system. Three developments have made such efforts necessary. First, the number of hours a student spends in a classroom per course has become more varied among American colleges and universities, thus vitiating the notion of a fixed equivalence between classroom hours and learning. Second, there has been an increasing realization that a person who masters the content of a college course should be awarded credit for it without regard to when or where the learning occurred, further undermining the notion of an equivalence between classroom hours and learning. And third, the amount of learning which a credit hour represents, and the extent to which credit hours can be added up for a degree, has become much more of an issue with the dramatic expansion of junior or community colleges in the United States and of student transfer from them to four-year institutions.

Despite whatever weaknesses the credit system may have, it has generally been regarded as a useful, standardized device for recording and counting student progress. Consequently, even though at only a few institutions does a Bachelor's degree still represent a fixed number of hours which the student has spent in the classroom, the general practice is to report his educational experience as if this were so. The fictitious-

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ness of this approach is obvious from the fact that compulsory classroom attendance is a vanishing practice among American institutions of higher education.

Furthermore, institutions are tinkering more and more with the academic calendar as a means of encouraging new kinds of learning experiences; for example, replacing the two semester calendar with the quarter system (three quarters roughly equal two semesters) or with the "4-1-4" calendar (commonly four months-one month-four months). These recent changes challenge the basic assumptions of the credit system because, as noted by the Registrar at Amherst College, Robert F. Grose, "this increased variation in calendars has already made fuzzy the standard number of weeks or contact hours for a credit". (1) Nonetheless, the formula of contact hours for earning credits and their accumulation for eligibility for a degree continues to be adhered to because of the relative simplicity it affords to academic book-keeping and flexibility of curriculum progress.

Recent developments in grading or marking student performance are also undermining the formula which equates eligibility for a degree with classroom hours. Traditionally, students have been awarded grades or marks in each course they took at college or university and their total academic record showed credit hours and grades for every course. This practice is changing fast. In many American colleges and universities students are now given the option of taking at least one course per semester or quarter on a "pass-fail" basis. The aim is to encourage students to select courses which they would shun if not freed from excessive concern over grades. In a study by the United Chapters of Phi Beta Kappa two years ago, 97 of 121 chapters replying to a questionnaire on whether their college or university offered pass-fail options responded affirmatively, although 64 limited students to taking only one pass-fail course per semester.

Not only are American colleges and universities moving away from recording how a student performs in a course, they are also modifying their grading systems so that a student's enrolment in a course is not recorded at all if he fails. This system is known as "pass-no credit". Yale University now follows this pattern, as do many others. The underlying rationale for this new non-traditional grading system is that "letter or numerical designations are often unfair and subjective, discriminatory towards students from minority backgrounds, the sources of unwarranted competition, a deterrent to students who might like to take courses in which they are unsure of themselves and, generally, not conducive to learning". (2)

Through the new non-traditional grading a double fiction is emerging. On the one hand a student's performance is recorded for courses where classroom attendance may be non-existent or have little correspondence to the learning experience involved. On the other hand even if classroom attendance is an integral part of the course, his performance and in fact his presence may not be recorded if he fails the course. Just as the content of higher education is adapting to new ideas of what students should learn and how, so is the means for recording it being modified to reflect new value judgments emerging in the system.

1. Robert F. Grose, "How Long is a Credit, When is a Course?", College and University, Vol. 46, (Autumn 1970), p. 23.

2. Gene I. Maeroff, "Grades, Question Mark on Marks", The New York Times, 26th November 1972, p. 7.

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CREDIT FOR LEARNING ACQUIRED OUTSIDE THE CLASSROOM

Leaving aside grades, the credit system measures higher education on the basis of two main elements: time and place. Changes in the academic calendar have brought reinterpretations of the credit hour chiefly in terms of time; how much time is required and the units into which it is divided. The new pass-no credit approach to grading is changing traditional formulae on how much of a student's performance measured by time is included in his total evaluation, by excluding from his record courses given a failing grade. Reinterpretations of the credit hour in terms of place accord recognition to the fact that work for a degree can be pursued in a range of higher education institutions and even outside them. Advance Placement and "CLEP" (the College-Level Examination Program), developed in the last decade or two, offer credit by examination for learning experiences outside regular college and university course work. Inter-institutional transfer enables students to work towards a degree at more than one post-secondary institution.

Credit by examination dates from 1943 when the United States armed forces experimented with college equivalency tests. So many young Americans were drafted into military service and hence missed out on college and university at the age when young people are normally admitted to higher education that the armed services sought to minimize the relative disadvantage of these young men in seeking higher education. Their objective was to have it recognized that members of the armed services could achieve competences through their military service equivalent to what they would have gained in certain college or university courses and should therefore be granted higher education credits for this experience creditable towards a degree.

Although the college equivalency tests tried out by the armed services during World War Two were not widely used, the principle behind them, explored with the post-war veterans' bulge in enrolments, caught on. In 1947 the testing activities of the College Entrance Examination Board, the Carnegie Foundation for the Advancement of Teaching and the American Council on Education were merged in the new Educational Testing Service (ETS). Building on the experience of the armed services the General Educational Development Test was developed to measure secondary school and college equivalent learning experiences. It is partly from this experience that the Advance Placement tests of the College Entrance Examination Board emerged. Students successfully passing these tests in subjects commonly required in the first year of college or university are excused from taking them, and may receive up to a year of academic credit towards their baccalaureate. Many secondary schools now offer Advance Placement courses which in effect are post-secondary level courses preparing for and evaluated by the Advance Placement tests.

Paralleling this has been the development of the College Level Examination Program of ETS which by now has an impressive battery of tests in a host of subjects. At many, though not all, American colleges and universities students successfully passing these tests gain academic credit in initial courses in their major and distribution requirements. Incidentally, by decreasing the time required towards the first degree, these tests reduce the total cost of degree studies for the students and the institutions.

Advance Placement and CLEP tests may be more pertinent to higher education in the United States than in countries abroad. They are useful in the American college and university context because of its focus on getting general education and distribution requirements out of the way

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before students can specialize in their major field. Advance Placement and CLEP enable American students to bypass the more routine courses at college or university, avoid repetition of previous study and move more rapidly to individualized advanced level courses. There may not be a comparable need in the university systems of other countries. However, where such tests might be most valuable abroad is in evaluating students wanting to transfer from non-university to university institutions within a given foreign higher education system.

MODULAR CREDIT: FRAGMENTATION OR INTEGRATION

The most recent alteration in the credit system which involves both time and place is the initiation at a few institutions, primarily within the School of Education of the University of Massachusetts, of what is known as "modular credit". Its purpose is to break down the tradition that learning should be compartmentalized into a given number of separate courses, each requiring a fixed number of student-faculty contact hours per week in a classroom or laboratory for a pre-determined number of weeks. Under the modular credit system one credit hour is broken down into 100 modules, a three-credit course thus requiring 300 modules. A credit module is earned for a learning experience requiring at least one hour. Modular credit can be offered for a single all day class, or for a single course lasting several semesters or more, or lasting for only one hour per month for several months. Modular credit can also be earned through independent study as agreed to by the student with his professor in an "individualized study contract".

The modular credit system is still so new in the United States that judgments on whether it is a practical alternative to the traditional credit system cannot yet be made. On the one hand by chopping the credit hour into a hundred smaller units, it may be more vulnerable to the criticism of fragmenting knowledge than the credit system. On the other hand its very flexibility may offer new opportunities for achieving greater integration in learning experiences. In any case, it seems probable that the modular credit system will be complicated to administer and to record.

INTER-INSTITUTIONAL PERMEABILITY: BACKGROUND AND FUNCTIONING

Where the credit system has most come into its own in the United States is in providing measures which are to an increasing degree interchangeable among colleges and universities in the recording and evaluating of student progress towards a degree. It is in this area that the American credit system may offer a model for facilitating more inter-institutional linkages within the higher education systems in other countries.

As noted earlier, the credit system was not developed in the United States to facilitate the inter-institutional transfer of students. This only became a significant phenomenon after World War Two when veterans of the armed services resumed in large numbers their college and university studies, interrupted by the war years, at institutions other than those where they had commenced their studies. Two phenomena which have

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come to the fore more recently - the dramatic growth in junior colleges and the quest by students for greater variety in their undergraduate education through spending a semester or year at another institution, often abroad - have made inter-institutional transfer an accepted rather than exceptional mode of pursuing the first degree. These developments have put pressure on higher education institutions to redefine and strengthen their procedures for admitting transfer students without depriving them unfairly of credits earned at other colleges or universities.

In general American colleges and universities now tend to grant undergraduate academic credit towards the Bachelor's degree for work undertaken at other institutions, provided this work can be considered as equivalent to degree level work at the receiving institution. Not surprisingly, the criteria used to evaluate this vary among institutions. The more elitist are likely to look at the transfer applicant's previous work on a course by course basis to see if it measures up in quality and content to what they offer at that level in their own programmes. The public four-year institutions which typically have a major commitment to public education and student access are now beginning to grant "block credit" to the transfer student for work accomplished elsewhere, and only to require the student to do extra course work if necessary to make up deficiencies in his major field. In general a student's desire to transfer from one institution to another is being regarded increasingly as evidence of his academic earnestness rather than of an absence of serious goals or of a tendency to drift.

A critical problem relating to the inter-institutional transfer of students is how to reconcile diversity among institutions with the maintenance of standards of excellence. The quality of students and of teaching vary among American institutions. Hence, if colleges and universities admit transfer applicants merely on the basis of numbers of credits and grades earned in courses, this could produce an influx of less capable and less well prepared transfer students into the higher quality institutions and precipitate a decline in their standards. Quality might be sacrificed to diversity. However, if transfer is possible only if the sending institutions have the same admissions criteria and teaching programmes as the colleges and universities admitting their transfer students, and admission is based not on the number of credits earned but on what kind of student at what kind of institution earned the credits and in what kinds of subjects, diversity might be sacrificed to quality.

Essentially, the problem is how to give students who began their studies in the less selective institutions, whether for reasons of inadequate secondary preparation, disadvantaged family background, weak motivation or other reasons, the opportunity to transfer to more challenging institutions if they show academic promise but are deficient in academic preparation. To state the problem differently, how can the better quality colleges and universities maintain their superior academic standards and admit transfer students on the basis of academic credits and grades earned and yet avoid dictating curricular programmes and admissions standards to institutions from which they admit transfer students?

The history of junior college transfer to the State University of California indicates how a partial approach towards solving these problems has evolved in the United States. In 1913 the University of California adopted the policy that transfer students eligible for admission upon graduation from secondary school were admissable at the university and were provisionally given full academic credit; other transfer applicants were considered on an individual basis. In the early 1920's certain junior colleges became affiliated with the University of California (and let it control their faculty and courses); the University agreed to admit transfer

students from these colleges with full academic credit. In 1931 policy shifted to allow the admission of transfer students on the basis of grades and credits; the fewer credits a transfer student had earned, the higher the grade average required. The current practice in public higher education generally is to base admissions mainly on grade average. Also, to enable the expanding number of junior college graduates to work towards the baccalaureate, the public four-year institutions tend to give such students some priority in admissions. Considering that at least 35% of total undergraduate enrolments in 1980 are expected to be in the junior colleges, this priority seems amply justified (even though only about two-thirds of junior college students are in programmes which are creditable towards the baccalaureate degree).

A number of impediments to the inter-institutional transfer of academic credits still exist. Few people would argue for their total elimination. A student transferring from a liberal arts to a technical college is unlikely to obtain transfer credit for courses taken in the former, such as fine arts courses, which have no course equivalent in the latter. Colleges and universities generally do not grant transfer credit for courses in which the student received a barely passing grade or only if this grade is balanced off by a superior grade in another course. Nor is transfer credit normally counted towards the number of credits required to be taken "in residence" at the receiving institution (usually between one-third to one-half of all credits) thus restricting the total number of transfer credits accepted towards the baccalaureate. Academic credit may also have a limited period of validity; some colleges and universities will only accept transfer credit if earned within a certain period. In general the qualifications for accepting credit require that the institution be accredited, that the credits be at least one grade above pass, and that courses accepted for transfer credit correspond to courses offered by the institution to which the student transfers.

Whether or not a college or university is "accredited" is only one of a variety of factors in credit transfer. In principle if an institution has been accredited by one of the various regional accrediting agencies in the United States (and interestingly enough these agencies do not define the work required for a unit of academic credit), work at that institution is deemed acceptable by all members of that or other regional accrediting associations. However, colleges and universities are only rarely obliged to accept transfer students from another institution because it is accredited. Most exercise discretion. In arriving at transfer admissions decisions, they take into account their own estimates of the quality of the "sending" institutions, estimates made possible by the lively though informal communication network among American academics which in turn is facilitated by their high degree of employment mobility.

The inter-institutional transfer of students is thus founded only partly on the credit system. To preserve the diversity among colleges and universities and to protect their institutional autonomy, when admitting transfer students each institution generally works out its own compromises between student access and standards of excellence in light of its particular traditions, needs and commitments.

THE ACADEMIC CREDIT SYSTEM: STRENGTHS AND WEAKNESSES

The credit system as it has developed in the United States is closely linked and often confused with the system of course electives. The so-

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called fragmentation of knowledge in American higher education is a product of the combination of the two systems. An even more important factor may be the fact that a higher education degree is typically broken down into four to five courses per semester for a total of eight semesters. As has been pointed out, however, this arrangement is not essential to the credit system and is being challenged and modified in a number of colleges and universities.

A typical feature of the credit system is that the performance of students is measured separately for each course rather than on the basis of other measures such as end-of-year or "comprehensive" examinations. The evaluation of the student on a course by course basis is probably the chief offender in fragmenting knowledge as it requires no interrelation between what students learn in individual courses. It has been shown, however, that the credit system can be combined with comprehensive examinations oriented to a discipline rather than individual course examinations, as in honours programmes.

In assessing the credit system its disadvantages must be weighed against its advantages. On the debit side the following can be listed:

a) Depending upon how small the pieces are into which higher education is broken down, the credit system may produce a fragmentation of knowledge.

b) The primary responsibility for integrating what is learned rests with the student and many students are incapable of handling this responsibility.

c) The assumption that learning experiences are interchangeable and that different learning experiences offering the same number of credits have equal validity denigrates the value of serious scholarly work.

d) The credit system implies that time-serving is the basic requirement for a degree, and fails to take account of the fact that what students learn may have little correlation with class attendance; learning may even be enhanced when classroom attendance requirements are reduced.

e) Another implicit assumption of the credit system, that students learn at the same rate, ignores the realities, namely, that some students master a given body of knowledge much faster than others.

f) Related to the foregoing is the implicit assumption of the credit system that there is no variation in the teaching skills of faculty members; it ignores the fact that students may learn more from a superior than from an inferior teacher with the same investment of student-teacher contact hours.

g) Measuring a higher education by a formula which in principle focuses on time spent in the classroom or laboratory gives an undue emphasis to form over content.

h) The credit system distorts student motivation in the learning process; students tend to look at higher education as the accumulation of course credits and not at learning as an end in itself.

i) The emphasis of the credit system on contact hours offers rewards to the student who is inclined to absorb what the teacher teaches in order to get a good grade rather than to the student who may be more genuinely engaged in the learning process and able to learn rapidly primarily through his own efforts with the assistance rather than direction of professors.

j) The credit system's emphasis on classroom attendance is incompatible with the new non-traditional forms of higher educa-

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tion which have as a premise that valuable learning can take place outside the classroom, as in independent study, work-study, internships and other experiences.

k) The credit system is unnecessarily expensive in time and energy. Higher education is defined only in terms of numbers of classroom hours over a predetermined number of semesters and years to meet degree requirements.

l) If learning is measured by credits, if each course has its own terminal examination, and if the credit system permits inter-institutional transfer of students, the end result of the credit system may be a wider range in quality among students certified by the system, whether through degrees, diplomas, certificates or other qualifications. The existing predictability regarding the product of a given higher education system may diminish and thereby reduce job predictabilities for graduates and dilute the whole notion of a "gold standard" of higher education. The system pertaining in some countries, which ties civil service and other positions to university degrees and to traditional standards of student performance within them, may have to give way to competency tests administered by future employers, both in the public and private sectors.

m) Assuming that the credit system widens opportunities for earning higher degrees, and that, as a consequence, the demand for degrees spreads, the role of higher education institutions certifying educational experience may come to dominate that of providing it.

The chief advantage of the credit system is that it breaks down the learning experience into standard units, in theory having equal weight, which can be accumulated towards a degree in a variety of combinations and at different times and places. To be specific the credit system permits the following possibilities:

a) Because a student's performance is judged in the credit system on a course by course basis, if he fails one of his courses in a given year, this failure is not treated as failing the full year, thus requiring him to repeat the full year's work.

b) The credit system makes it possible to offer higher education in a variety of units by assigning varying amounts of credit to different courses, for example, year, semester, three week or even one week courses, thus eliminating the myth that regardless of subject matter all courses are of equal weight.

c) By the same token the credit system offers more variety in the academic calendar as it can be broken up into a range of segments corresponding to the different amounts of academic credit offered. This feature of the credit system facilitates the year-round operation of higher education institutions as it permits summer sessions to become an integral part of higher education offerings.

d) The credit system provides a mechanism to enable students to work towards a degree at their own pace by pursuing higher education on a part-time basis, alternating periods of work and study, and stopping in and out of higher education as this fits their personal and professional goals and life situations. The credit system can thus integrate degree study with continuing or recurrent education.

e) If the credit system is combined with awarding credit by examination, it enables the student to apply towards a degree learning experience obtained outside the higher education system and thereby reduces the time and cost required for a degree.

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f) Assuming that credit can be awarded for educational experience which takes place outside the classroom by assigning credits on an "as if" basis, the credit system makes it possible for independent study and a variety of non-traditional learning experiences to be creditable towards a degree, thus significantly broadening the range of educational experiences open to students.

g) The credit system offers greater flexibility to students to change their major field in mid-stream; instead of requiring the student to begin his programme anew, it counts his previous work towards his degree, requiring only such additional work as is necessary to fulfil major and related requirements.

h) Because in a credit system the initiation of new courses tends to be easier than in a system having a fixed curriculum, the credit system enables higher education institutions to be more responsive in adapting curricula to new needs and interests.

i) If the credit system is combined with course electives, as in the United States, it enables higher education to be more student-oriented and individualized than is possible with a relatively fixed curriculum.

j) Assuming that course rather than comprehensive examinations are characteristic of the credit system, it gives considerable independence to teachers in determining what they teach and how.

k) Probably the chief strength of the credit system is that it permits inter-institutional transfer of students, enabling each individual to develop to the limit of his capabilities by permitting him to move from one institution to another in accordance with his aspirations and ability.

l) Finally in connection with inter-institutional transfer the credit system preserves the curricular autonomy of higher education institutions, many of whose students typically transfer to university because it does not require the "sending" institutions to duplicate the basic curricula of the institutions admitting transfer students.

From the foregoing summary of the pros and cons of the credit system, it is apparent that the system does not lend itself to easy assessment. It has its supporters and its critics, and recently in the United States it has had its adjustors, as individuals and institutions have devised ways to modify it in order to remedy some of its rigidities.

In evaluating the credit system it may be useful to identify the basic premises, concerning higher education, of its critics and its supporters. The former tend to assume that one can define an "educated man" and hence can identify the essential components of a higher education, particularly in the non-professional fields. By chopping up higher education into fragments, not necessarily inter-related (assuming again that the credit system is coupled with course electives), the credit system often fails to produce the "educated man". The supporters of the credit system, on the other hand, admit the impossibility of defining the educated man, reject the notion of such a definition as rigid and even obsolete, and view student curricula choice and student-oriented higher education as more appropriate to an era characterized by dramatic technological change, the democratization of higher education, and increasingly varied and unpredictable career patterns.

The above comments illustrate a problem, already touched upon in earlier sections, of differentiating between the credit system and the elective and transfer systems with which it is closely identified. Those

outside the United States who advocate the adoption of the American credit system in their own higher education systems sometimes assume that by attaching credits to learning experiences, educational opportunity will be widened through inter-faculty and inter-institutional transfer, course offerings can be more diversified, higher education will become more student-oriented and recurrent education will be strengthened and integrated into the higher education system.

The adoption of the American credit system cannot assure such changes. All that the credit system can do is assign a numerical value to individual courses so that progress towards a degree can be quantified. In the United States the operation of the academic credit system rests on a series of assumptions which are not readily exportable and in fact may have few counterparts in higher education systems abroad. Now that over half of all secondary school graduates in the United States enrol in post-secondary education and because wide access has become a priority, the credit system is viewed as a mechanism to enhance the opportunity for higher education. However, inter-institutional transfer does not flow automatically from the credit system. No one assumes that English 101 is the same in "Podunk, Iowa", as at Harvard. The flexibility in higher education opportunity associated with the United States depends upon how individual disciplines, faculties and institutions rank each other and each other's students.

In conclusion, the advantages that adoption of the American credit system may appear to offer to foreign higher education systems should be carefully assessed. In the United States these benefits are probably related more to the underlying premises on which the credit system operates than to the credit system itself. The American credit system could therefore only be usefully exported to foreign higher education systems if these systems were founded on or moving towards values similar to those which the American credit system tries to implement. And if the foreign higher education system is already committed to these values - wide access, inter-faculty and inter-institutional transfer, curricula choice, the integration of recurrent education with the degree system, student-oriented higher education, applying external experience towards a degree, etc. - then the credit system may be superfluous.

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IV

THE FUTURE OF THE CREDIT SYSTEM IN AMERICAN HIGHER EDUCATION

The foreign observer of current trends in higher education in the United States is probably bemused if not bewildered to see that, while traditional formulae for measuring academic progress on the basis of hours spent in the classroom are rapidly eroding, almost all colleges and universities continue to adhere to the academic credit system even though in theory it assumes a correlation between "chair-sitting" and the acquisition of a college or university education. On rational grounds the academic credit system would appear to be fast becoming irrelevant. More specifically, two important trends may be hastening this development: a shortening of first degree programmes and the emergence of non-traditional studies.

The Carnegie Corporation of New York, one of the major philanthropic foundations supporting higher education in the United States, is encouraging the first trend. As stated in its 1972 Annual Report:

> "The Corporation's program in higher education in recent years has reflected the country's growing interest in alternatives to the traditional four-year college degree. Grants have been made to a number of institutions awarding degrees or credits based on examination and on flexible independent courses of study. Many of the programs are built around the concept of the time-shortened, or accelerated, degree - a concept which has implications both for improvement in the quality of higher education and for economy of operation, and a challenge which is considered well within the capabilities of today's more sophisticated and better prepared generation of students. Four basic approaches to the time-shortened degree receiving Corporation support this year are being tried on various campuses: credit-by-examination; year-round enrolment; the omission of one high school year; and design of a three-year curriculum. "(1)

With more than half the eighteen year olds now entering college or university, the pressure of mounting higher education costs as well as the need to improve quality suggest that the time-shortened degree will become increasingly significant in the future. Although not necessarily incompatible with the credit system, the shortened degree period is forcing adaptations in the system.

Non-traditional study, also looked at to some extent as a potential means to limit higher education costs, constitutes another major force

1. Carnegie Corporation of New York, Annual Report for the Fiscal Year ended September 30, 1972, New York City, 1972, p.16.

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for the modification of the credit system in the United States. The Commission on Non-Traditional Study, set up two years ago by the Educational Testing Service and the College Entrance Examination Board, described non-traditional study in a report issued in February 1973 as follows:

> "It is an attitude that puts the student first and the institution second, concentrates more on the former's need than the latter's convenience, encourages diversity of individual opportunity and de-emphasizes time and space or even course requirements in favor of competence and, where applicable, performance. It is not a new attitude; it is simply a more prevalent one than before." (1)

In terms of recent secondary school graduates the United States now has mass higher education and is moving towards "universal". Non-traditional study offers the opportunity for post-secondary education to new kinds of student populations regardless of age, thus achieving a more genuinely universal post-secondary education system. It enrols older persons who dropped out of college or university or never entered, housewives and working people in many kinds and levels of employment. Rather than requiring them to fit into traditional four-year full-time programmes, non-traditional study offers the possibility of part-time study, of acquiring skills and knowledge towards a degree without ever setting foot on a campus, and of having significant prior learning achieved outside a higher education institution, counted towards degree requirements. Two of the leading American institutions in non-traditional study, Minnesota Metropolitan State College and Empire State College of the State University of New York do not even have a campus. Britain's Open University is yet another model, and variations of it are fast developing in the United States.

The Commission on Non-traditional Study has not urged the abandonment of the credit system as a corollary of non-traditional study. However, in one of its recommendations the Commission implied that rigid adherence to the traditional credit system may be an obstacle to the emergence of non-traditional study. The Commission recommended that "there should be continued experimentation with forms of non-traditional study which minimize the traditional rigidities of campus life: time (prescribed years of study); space (residence on campus); and systems of academic accounting (credits or honour points earned)".

The need for more flexibility in education and new ways to evaluate competency have been stressed by K. Patricia Cross, senior research psychologist at Educational Testing Service and research educator at the Center for Research and Development in Higher Education at the University of California, Berkeley:

> "No one can put forth a very strong argument that four years, chopped into 120 credit hours delivered to people, who can present themselves physically in a room set aside for "classes", makes much sense as the major strategy of education. A concept of education for all the people requires new methods of delivery to take education into prisons, homes and industrial plants. We need new measures of competency that acknowledge that what is learned rather than how it is learned is the true measure of education. And we need new flexibilities that can begin to make lifelong learning a reality." (2)

1. Gene I. Maeroff, "Colleges Experiment with New Ways for Workers and Housewives to Pursue Studies", New York Times, 14th February 1973, p. 23.
2. K. Patricia Cross, "The New Learners", Change, Vol. 5, No. 1, February 1973, p. 39.

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Federal legislation on higher education adopted in 1972 seems to aim at giving increased priority to non-traditional study and to widening access to post-secondary education to all ages, implying possible further erosion or adaptation of the credit system. The Educational Amendments of 1972 to the Higher Education Act of 1965 set forth the following aims for federal support to improve post-secondary education:

> "Encouraging the reform, innovation and improvement of post-secondary education and providing equal educational opportunity for all; ...
>
> "The introduction of institutional reforms designed to expand individual opportunities for entering and re-entering institutions and pursuing programs of study tailored to individual needs; ...
>
> "The creation of new institutions and programs for examining and awarding credentials to individuals, and the introduction of reforms in current educational practices related thereto."(1)

The Fund for the Improvement of Post-Secondary Education, a newly established body within the US Department of Health, Education and Welfare, will encourage the implementation of these and other aims. Congress has authorized $10 million for the Fund for the current fiscal year. Although it is too early to predict what kinds of programmes and innovations this new federal agency will support and what impact, if any, they will have on the academic credit system, it seems likely that non-traditional study of many kinds will gain the Fund's support and accelerate present trends towards modifying the credit system.

It is difficult to predict whether or not the credit system will be abandoned in the face of the foregoing trends and developments. Experience up to now, and especially in the last few years, shows that despite the system's alleged rigidities, colleges and universities have found ways to reinterpret credit constraints to achieve the greater flexibility in curricular programmes required by changing needs. A variety of learning experiences regardless of where and when they occur can now be accumulated towards a degree although, of course, practices differ widely among institutions.

New approaches are being developed for evaluating educational experience for degree purposes; for example, the portfolio approach mentioned earlier used by Manhattanville College. The study contract, yet another approach which is being increasingly widely adopted, is a variation on independent study, allowing students to carry out individualized study programmes which are evaluated on the basis of the student accomplishing the contract goals initially worked out with a faculty adviser. However, no single model for evaluating non-traditional study dominates, and the very heterogeneity of approaches, some new, many vintage, reflects present dilemmas in finding appropriate means of academic assessment for new kinds of learning experiences.

Not to be ignored in projecting the future of the credit system are the increasing doubts cast on its alleged usefulness in assessing the workload of staff, the time the individual teacher spends in class. Notions of standard staff teaching loads have assumed a correlation between the number of credits taught by a teacher and the time he/she spends in the classroom. However, various studies have tended to invalidate this assumption. As rising higher education costs require more sophisticated approaches for relating the allocation of resources to outputs, the utilization of the credit system as a measure of output may give way to more

1. Public Law 92-318, 23rd June 1972, p.93.

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refined analyses: for example Program Planning and Budgeting Systems. Thus, whatever past support the credit system has had for its use as a faculty workload index would seem likely to diminish. (1)

Finally, intangible and speculative as it is, the possibility that the need for academic degrees may receive less emphasis in the future may emerge as one of the major factors in further diluting or even abolishing the credit system. The subjects of accreditation and credentialling are being increasingly debated in the United States. Present trends suggest that adult education free of credit will be accorded substantial priority in the decades ahead. Given the necessity to find alternative ways to measure educational progress, to provide post-secondary education to adults, to abandon the old constraints which define higher education in terms of where and when it takes place, to assure a more efficient utilization of faculty and other resources, and to provide increased educational opportunity outside as well as within the academic system, the credit system may give way to new and as yet undefined approaches to providing and evaluating education.

As an accounting system facilitating individualized education and inter-institutional permeability, the credit system has made an important contribution to American higher education. It has demonstrated surprising adaptability. Whether or not its adaptability will extend to the new needs now emerging is one of the imponderables of higher education in the United States today.

1. For a recent discussion of this and other aspects of the credit system see James M. Heffernan, "The Credibility of the Credit Hour: The History, Use and Shortcomings of the Credit System", Journal of Higher Education, Vol. XLIV, No. 1, January 1973, pp. 61-72.

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